ENGINEERING NEWS

A JOURNAL OF CIVIL, MECHANICAL, MINING AND ELECTRICAL ENGINEERING

Vol. 60. No. 6. 220 Broadway, New York, August 6, 1908.

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A NEW SEWAGE PUMPING STATION AT BALTIMORE, MD.

Included as a part of the comprehensive sewerage and sewage disposal system now being constructed for the city of Baltimore, Md., is a large pumping station. Work on this station was begun on June 29 by the Noel Construction Co. as contractor. All the sewerage work is being carried out by the Sewerage Commission of the City of Baltimore, of which Mr. Calvin W. Hendrick is Chief Engineer.

We present herewith a reproduction of a wash drawing of the new station, the architect for which, acting in conjunction with Mr. Hendrick, is Mr. Henry Brauns. The station is located between East Falls Ave. and President St., on Jones' Falls, and is accessible by both rail and water. The contract prices for the station complete aggregate $748,955, of which the foundations make up $119,755, the superstructure $179,200 and the machinery $450,000.

The station comprises an engine-room 180 ft. long, 54 ft. wide and 68 ft. high from the basement floor to the tie-beams of the trusses; a boiler-room 94 ft. long by some 50 ft. wide; and a brick chimney about 6⅔ ft. in diameter at the top and 200 ft. high above the boiler-room floor. Coal bins with a capacity of 1,200 tons will be placed above the boilers.

NEW SEWAGE PUMPING STATION FOR BALTIMORE, MD.

The foundations of the building will be carried to a depth of 23 ft. below mean low tide, or some 31 ft. below the surface. The walls of the building, to the height of the main floor, will be of granite, and above that level they will be composed of light brown brick with terra cotta moldings. A copper cornice will be provided, and the roof will be of slate on steel trusses carried by steel columns built into the walls. The columns will support a traveling crane. The engine-room will be lined with enameled brick to a height of 23 ft. above the basement floor, and beyond that level cream-colored impervious brick will be used.

Eventually there will be five sewage pumping engines, but only three will be installed at present. There will also be provided two drainage pumps, a 20-ton electric crane, and electrically-operated valves. The sewage pumping engines will be of the vertical triple-expansion crank-and-fly-wheel type, with steam cylinders 22, 41 and 62 ins. in diameter, and three single-acting 40-in. plungers all of 60-in. stroke. The nominal engine speed is 20 r. p. m., at which each engine will deliver 27,500,000 gals. of sewage in 24 hrs. against a head of 72 ft., developing about 400 HP.

Ultimately there will be four force mains, each 42 ins. in diameter, but for the present only two of these will be built. It is assumed that two of the sewage pumping engines will be sufficient to handle the average sewage flow in the low-level intercepting sewers until the population reaches 1,000,000.

The two 12-in. centrifugal drainage pumps, driven by 40-HP. compound condensing engines, will have a capacity of 3,000 gals. per minute each. These pumps will draw water from underdrains laid beneath the intercepting sewers. This water will be discharged through the condensers of the sewage pumping engines, or alternatively directly into the harbor.

The boiler plant for the present will include three 265-HP. water-tube boilers, one economizer, and coal and ash-handling machinery. Two additional boilers will be installed later on, and also another economizer. The economizers have 1,400 sq. ft. of heating surface, and will raise the temperature of the feed-water from some 90° to 200° F.

The screen chamber will be located between the main engine-room and the boiler-room, and between a receiving reservoir and the sewage pumps. The incoming sewage will pass through a set of movable screens and then through fixed screens, the latter located over the suction pipes of the pumps. The movable screens are designed to take out coarse materials, only, and will be hoisted up for cleaning. Such material as collects on the fixed screens will be raked off by hand.

It is proposed to reduce the water in the screenings by means of steam or hydraulic presses, and then to burn the screenings in a furnace located in the boiler-room basement.

THE FILING SYSTEM OF THE NEW YORK BOARD OF WATER SUPPLY.

By J. LEO MURPHY.*

The knowledge that money can be saved by economizing time and labor as well as by preventing actual waste of materials has been the incentive for the invention of many mechanical devices that are found throughout the industrial fields.

Filing systems, office systems and all systems that accomplish at once the economic filing of the accumulated records of a business and keep them available for ready reference come properly in this class. It is not, however, easy to compare alternative filing systems, or form an adequate idea of the merits of any one on the basis of dollars and cents saved in operation, without actual trial, nor after trial is it easy to justify the expense of operating an elaborate system by contrasting its cost with the saving in time to the individuals consulting the files, for the first is a positive yearly expense which will stand out clearly in the accounts of a municipality, company, or individual, while the latter can only be arrived at by guess or rough calculation. It is needless to say which is apt to be more convincing.

Briefly, the requisites directly affecting the cost of a good filing system may be stated as follows:

(1) The cost of operation, when organized, should be a minimum.
(2) Data should be obtainable from the files in a minimum time. That is, the saving of time to those using the files should be a maximum.
(3) It should be possible, if so desired, to file at all times with a maximum economy of space; or, what is in fact the same, the system should permit of expansion at any time, with no other change than transferring data from one place to another.
(4) The system should not be so complicated as to require for its successful operation the observation of so many rules or routines as to exact a constant tribute of time from those it serves.

The science of collecting and filing data economically, unlike other sciences, has no inherent virtue; its merit depends solely on how well it will serve some other and more important art, science or business. It is always a tool aiding to turn out the marketable article, or a

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unit that furthers the aim of the institution it serves. This fact is often lost sight of from within the contracted horizon of those engaged in the design or operation of a filing system; they are apt to be carried away by theoretical niceties and lose sight altogether of the main object of their endeavors, namely, to produce a time-saving machine. For a parallel, one has only to look at the countless mechanical freaks that mark the wasted energies of impractical inventors.

Conversely, in introducing a system that is not based solely on the elemental topics of the work whose data it is to classify and file, the initial study that is necessary for individuals to devote before the system becomes operative is apt to be mistaken by them for a defect which will result in a continued loss of time. Must not every workman first learn to use the tools of his trade? The machinist his lathe, the engineer his transit, slide rule or logarithms? None of these aids would be condemned on account of the initial study required to apply them.

Among engineers the old tradition that records should be kept as much as possible in the individual's head seems still to persist. Money spent on files and filing is considered a loss assiduously to be avoided, the routines necessary to operation are found irksome, and the time spent in learning a system that has not been designed especially for one's individual conditions, but rather selected as a happy medium suited to a comprehensive organization, is regarded as wasted, all arguments to the contrary notwithstanding.

Though filing systems have been slow in establishing themselves, they are now recognized as a necessary adjunct to all large organizations. Many commercial houses have found it necessary, in order to cope with the rapid development of their business, to revise at considerable inconvenience and expense old methods of filing whose design had been based on an estimate of future requirements. In such cases, expert advice has usually been sought and it has been the aim to secure a system that would not again be outgrown by the business. Results have amply justified the changes.

THE NEW YORK BOARD OF WATER SUPPLY FILING SYSTEM.

Profiting, therefore, by the experience of others considerable study has been devoted in organizing the Engineering Bureau of the Board of Water Supply to the selection of a filing system that would not only continue adequate indefinitely, but which would be uniform alike in all offices of the board, and for the diversity of data to be filed, namely: drawings, computations, correspondence, field notes, estimates, force accounts, etc. No accumulation of old data hampered or influenced the selection of the system, if such may properly be considered an obstacle, for valuable hints can often be drawn from old records. The result has been the system herein described. How far it accomplishes the object of its designers remains to be seen, but in the brief interval of its use it has given entire satisfaction, due allowance being made for the difficulties of organization and getting under way.

The success of any filing system, however simple or well adapted to the requirements of a business, is judged to a great extent by the rapidity with which matter can be located in the files. This, in turn, depends on the accuracy of the filing force. While simple in principle, this filing system is not automatic and cannot be understood and applied successfully without careful study alike by the filing force and by the engineers. That it must be studied does not indicate an inherent defect, nor constitute a valid objection against it, for on the contrary the system is peculiarly adapted to filing the diversity of data for which it was designed.

A study of the system herein described will reveal, beside its conformity with the above principles, the following advantages:

(1) Subjects are grouped and held by the file numbers in the relation to each other that serves best the conditions of the work. Therefore, allied data will be found together in the files, and not widely scattered throughout them.

(2) The system is rigid, inasmuch as the same subjects are always in the same relation to each other, but the decimal file-numbers permit of ready coordinate expansion.

(3) Integral numbers dispense with the necessity of limitation to ten classes, similar to those of the Dewey system, which would be impracticable where structures are concerned.

(4) It is applicable to all classes of data.

(5) All files are identical, so that the individual understanding files in one office can operate those in any other. Men transferred from one office to another do not have to learn a new filing system.

(6) Data interchanged between offices does not have to have file numbers or other changes made on it; it goes into the same pigeon-hole, wherever its destination. Indexes do not have to be changed when data are moved from place to place, either in the same office or from one office to another.

(7) The minimum filing space can always be used; a large space does not have to be allotted on a guess at future conditions.

(8) Expansion can be made from month to month or from year to year whenever desired, without changing file numbers, indexes or other marks that locate a drawing in the files.

(9) The results of one man's studies or investigations are made readily available to all.

(10) The system continues good indefinitely and will not be outgrown by the business it serves.

The following may be considered disadvantages:

(1) It is necessary to arrange the subject list long before the work. Subjects are therefore grouped rigidly in a relation that may not prove good.

(2) Engineers must study the system so that they can arrange their work so that it can be filed readily without an undue amount of cross indexing.

(3) The rigidity of the grouping does not lend to filing data on structures when they are studied in a different connection from what the subject list contemplated in its original design.

THE INDEX.

The selection of a proper list of subjects was the first and most important step and the nature of the work of the board was, of course, the guide. This work is water-supply engineering in the broadest sense, and will have to do with the design and construction of principal structures, reservoirs, aqueducts, filters, power-plants, etc., together with their accessory structures, dams, gate-houses, siphon chambers, etc., and incidental work such as highway relocation, railway relocation, bridges, etc., involved in a comprehensive system.

The index or subject list includes, first, the principal or "main structures" to be built, supplemented by an enumeration of headings relating to materials, methods and generalities. The "main structures" are fully subdivided and the remainder of the list may be amplified or divided from time to time as necessary. Each subject is given an integral file number and its subdivisions are given decimals as in the Dewey system.

All the main heads in this 1-n index, as it is called, are given in the accompanying table, and in addition all the sub-entries are given for the first three main heads and a portion of the subheads for the fifth main head. "Treatment" and "Locality" letters are used with the file number. They are described elsewhere in this article.

MAIN OR 1 TO N INDEX USED IN FILING SYSTEM, NEW YORK BOARD OF WATER SUPPLY.

1.0 WATER SUPPLY ENGINEERING. General Schemes, Considerations, Problems and Summaries of a broad nature involving several topics.
General schemes of water supply, such as:
Dutchess and Esopus development as proposed by Burr-Hering-Freeman Commission.
Catskill development as proposed by Board of Water Supply.
Rondout, Schoharie, Catskill or East Branch of Delaware sources considered separately.
Long Island Ground Water Scheme.
(N. B.: Only summaries appear here. The computation sheet form provides for reference on each part, the individual parts of computation from which summaries are made, i. e., Stormville Reservoir, Catskill Aqueduct, etc., would be put under their respective heads. The fact that the computation on these details of the whole were made in connection with a certain summary is to be recorded on the individual computation after the heading "Made in connection with." This serves the double purpose of a cross-reference and a clue to the probable accuracy and the general value of a given detailed computation which might be used again in a future computation.)

.3 Economic studies of a broad nature, such as:
Economic outlet elevation of Ashokan reservoir (involving both aqueduct and reservoir costs).
Economic development of Catskill sheds (involving several aqueducts and reservoirs).

.4 Statistics relating to Water Supply Engineering.
Population of towns and cities, growth of (Curves and study leading to forecasts of population).

.43 Water consumption.
Use tabs to subdivide under this (1.0) subject, as the matter filed here is necessarily general and therefore difficult to classify under any generic head, or, having been once filed, is difficult to locate by another person whose classification might not be the same.
In computations, therefore, tabs should be liberally used to separate the different studies.
In the correspondence files most of the data filed here should be cross-indexed by cards, under a sufficient number of headings to insure its location at any time.
Plans, as a rule, will be specific [illegible] made in connection with a general scheme and therefore will be filed elsewhere. Some may be filed here, however.

2.0 WATERSHEDS, General. Quality of water, rainfall and runoff. (Do not file data on improvement work here. Improvement of watershed, should be charged to some reservoir and be filed there.) (Use B before file number for statistics.)

.2 Rainfall:
.22 Measurements and Gagings.
Rain Gages.
Conditions affecting rainfall. (Explanatory, for correspondence file.)

.3 Evaporation:
.32 Statistics and records.
Conditions affecting evaporation. (Explanatory, for correspondence file.)

.4 Runoff and Stream Flow.
.42 Measurements and Gagings.
Weirs and Gaging Stations.
.43 Conditions affecting stream flow.
.44 Quality of water examinations and tests analyses (on shed, in stream, but not in reservoirs).
Conditions affecting, such as population on watershed, geological formation, etc.
.441 Physical examination, tests and records.
Turbidity, Color, Odor, Taste } Explanatory for correspondence file, use tabs to separate records.
.442 Chemical examination.
.443 Bacterial examination.

3.0 RESERVOIRS (Distributing and Impounding, the latter with their tributary watersheds. For main structure of distributing reservoir see 3.5).
Each reservoir likely to be considered, whether City of New York or other, whether built or only proposed, is to be represented by its initial and another letter if necessary.

A—Ashokan.	Hb—Hibernia.
B—Billings.	K—Kensico.
Cr—Croton.	P—Prattsville.
F—Fishkill	H—Hillview.

The main heading 3.0 is intended to include both kinds of reservoir. Some of the subdivisions obviously apply to only one type, as in the case of 3.4 Dams (usually with impounding reservoir) and 3.5 Main Structure of a distributing reservoir. The other subdivisions have been developed with the intention of applying them to either type (as in the case of 3.3 improvement of site and 3.7 Gate Houses). The locality letter after the file number serving to separate the two types, as 3.0 A and 3.0 Hi. Ashokan and Hillview, respectively.
Availability of site with reference to topographical and geological features, etc.
Development of site.
These are general headings and tabs may be used for separating computations if necessary. Under 3.0.

.1
.2 Capacity and Yield (involves area, rainfall and runoff, storage and depletion. Rainfall and runoff data are to be filed in rainfall and runoff file).
Area.
Elevation of flow line.
Storage and depletion-diagrams, etc.
Depth of flowage.
Measures to increase capacity.
These are general considerations and are enumerated only to aid in filing correspondence. If necessary, use tabs to separate computations under the general heading 3.2

.3 Improvement of Site (including improvement on watershed, with impounding reservoir).
.32 Clearing and grubbing.
.33 Stripping, sanding, treating.
.34 Slope paving, etc.
.35 Removal of artificial sources of contamination, including construction of sewers, etc.
.36 Swamp improvement and diversion.
.37 Finishing, horticulture, landscape gardening, etc. (Not at gate house, dam or other special structure.)

.4 Dams and Dikes, to be known by letters. Board of Water Supply dams to be filed under their respective reservoirs; foreign dams, even when important enough to be represented by a letter, to be filed under reservoirs and dams in general. Method shown in following list:
3.4AO—Olive Bridge Dam of Ashokan Reservoir.
3.4AT—Tongore Dam.
3.4AA—Ashton Dam.
3.4AB—Brown's Station Dike.
3.4KV—Valhalla Dam of Kensico Reservoir.
3.4Q—Quaker Bridge Dam (of Croton reservoir but not so filed).
Relative advantages of site—availability of, with reference to topographical and geological features, etc. (General. Use tabs, if desired.)

.41 Theory (Divisions of design).
.412 Ice Thrust.
.413 Upward water pressure.
.414 Vacuum.
.415 Internal stresses.
.416 Temperature, cracks, expansion joints, interior drainage.
.42 Earth Dams or dike (Materials and methods of construction).
Location, site. Cross sections. Profiles. } Use tabs to divide if necessary, under 3.42.
.421 Theory (not included under 3.41).
.422 Preparation of foundation, excavation.
.423 Earth work of dam, filling, etc.
.424 Core-walls.
.425 Paving and riprap, sodding, slope protection, etc.

.426 Prevention of leakage-drainage.
.43 Masonry dams, cyclopean, rubble, concrete, etc., not overfall sect.
Materials and methods of construction.
Location, site.
Cross sections.
Profiles.
} General, separate by tabs under 3.43, if necessary.
.431 Theory (not included under 3.41).
.432 Excavation, earth and rock, preparation, foundation, faults, seams, springs, etc.
.433 Embankment.
.434 Masonry.
.435 Interior Drainage.
.436 Gate houses, if monolithic with dam (piping and appurtenances).
.437 Finishing.
.44 Masonry dams, overfall sections, waste weirs, spillway.
Location, site.
Cross sections.
Profiles.
Materials and methods of construction.
} General, separate by tabs under 3.44 if necessary.
.441 Theory (not included under 3.41). (Waste channels, capacity of flow, etc.)
.442 Excavation earth and rock.
.443 Embankment.
.444 Masonry.
.445 Interior Drainage.
.446 Gate houses.
.447 Special structures.
.45 Reinforced concrete and other dams (not coffer dams).
.46 River control.
.462 Coffer dams, and other temporary dams, cribs.
.463 Flumes (not for general use; flumes general see 5.5).
.464 Pipes, conduits, culverts.
.465 Regulating devices, gates, etc.
.5 Main structures (distributing reservoir). General: Considerations of type covered, uncovered, steel, reinforced concrete, adapting an existing structure or reservoir. (Separate under General head by tabs if necessary. Individual parts of summaries should be filed in the proper subdivisions.
.52 Preparation of site.
.522 Excavation, earth and rock, disposal of spoil embankment and fill (preparation of bottom and sides, refill, back of retaining walls and on roof).
.53 Masonry structure.
.531 Floors.
.532 Walls.
.533 Piers.
.534 Roof (including manholes, roof drains, etc.).
.56 Materials and methods of construction.
.6 Conduits and piping (to junction with supply aqueducts, and inside main structure. Any specially important conduit to be designated by letter, thus: circulating conduit in Ashokan Reservoir would be known as 3.6 Ac. Also except surface drains and except in gate house).
.61 Of concrete.
.62 Of steel.
.63 Of cast iron.
.64 Tunnels.
.65 Stop valves and appurtenances.
.66 Open channels.
.7 Gate houses (if separate from masonry of dam). Special gate houses to be designated by letter, thus: 3.7KA—gate house No. 1 in Kensico Reservoir. Structures and piping made necessary by power plant are included therein, not here.
.72 Excavation and fill, also horticulture, etc.
.73 Foundation and chambers.
.74 Floors up to superstructure.
.75 Cast iron pipes and drains.
.76 Gages, weirs, pumps, cranes, etc.
.77 Sluice gates, stop valves, stop planks and appurtenances.
.78 Superstructures.
.8 Incidental work and maintenance (not landscape work).
.81 Roads, highways (use letters to designate important ones).
.811 Excavation and embankment; also horticulture.
.812 Surfacing.
.813 Culverts.
.814 Bridges.
.815 Fences.
.816 Drains.
.817
.82 Railroads (Use letters to designate important ones).
.821 Excavation and embankment; also horticulture.
.822 Ballast.
.823 Track.
.824 Culverts and drains.
.825 Bridges.
.826 Fences.
.83 Lighting and telephone.
.831 Ducts and manholes.
.832 Poles.
.833 Lighting, cables, wiring and fixtures.
.834 Telephone, cables, wiring and fixtures.
.84 Special structures.
.85 Maintenance.
.851 Houses, laboratory, stables, etc.

4.0 INFILTRATION GALLERIES AND WELLS. General. California stove-pipe wells.

5.0 AQUEDUCTS, GENERAL.—Under general heads use tab cards to separate computations.
Use locality letters after file number for particular ones—thus C = Catskill. R = Rondout.

.2 CUT AND COVER (grade aqueduct).
Use locality letters or section numbers for local stretches—thus 5.2 CSg = stretch of cut and cover aqueduct (Catskill) in town of Shawangunk.

.3 Grade tunnel, general, including proper (main structure) and shafts. General studies of location, number of shafts, etc. General studies of materials and methods of construction. (File details of Contractor's plant when of sufficient importance in proper sub-division of B11.0.

.4 SIPHONS, pressure aqueduct.
Use locality letters for local stretches—Hb = Hunter's Brook, R = Rondout, E = Esopus, W = Wallkill, M = Moodna, S = Sprout Brook, P = Peekskill Creek, H = Hudson River, Fl = Fishkill.

.42 Steel pipe. (Materials and methods of construction).

.43 Pressure tunnel, general. Siphon as a whole, including siphon and drainage chambers, waterway and drainage shafts and tunnel, proper (main structure) between waterway shafts. General studies of location, number of shafts, etc. General studies of methods of drainage (.4302) and of materials and methods of construction. Details to be filed in their proper subdivision here and under Contractor's plant B11.0 when sufficiently important.

.44 REINFORCED CONCRETE PIPE.

.45 CAST AND WROUGHT IRON PIPE.

.5 OPEN CHANNELS. (Materials and methods of construction.)

6.0 GRAVITY FILTERS. General consideration of methods of treatment, etc. Designate individual plants by letters, thus: S—Scarsdale, St—Stormville, G—Greenburg. J—Jerome Park. There will be a number of more or less radically different schemes for any plant studied. Hence at the outset sub-figures should be started to go with the initial letters of plants; thus: S1, S2, S3, etc.

7.0 MECHANICAL FILTER PLANT. General problems relating to methods, etc.

8.0 DISTRIBUTING CONDUITS, General.

9.0 AERATION WORKS.

10.0 WATER POWER DEVELOPMENT. General. Preliminary investigations and reports on this subject filed here. The power plant would be filed under 11.0. Preliminary survey maps and notes may be filed here if desirable.

11.0 PLANTS—Power and Pumping Stations, Machines, and Mechanical processes in general, Contractor's Plant, Miscellaneous Machines—not to include boring outfits, which file under 70.2. Contractor's Plant is filed B 11.0. Under 11 record all general studies on power plants or appurtenances and all particular plants that are large enough to be considered units in the system of supply, apart from other main units. Plants such as those for draining particular siphons or for furnishing wash water and light to filters have been considered to be attached to the particular siphon or plant. It may be wise, however, to make an exception and put them under 11.0. The main objection is, that in the files and in the distribution of costs the real scope and cost of the main structures are made hard to get at by separation of their components.

12.0 Sewerage and sewage purification—General.

13.0 Roads, Highways, drives and paths—General.

14.0 Railroads—General.

15.0 Bridges (highway, railroad and aqueduct)—General.

18.0 CEMENT, General. Use tab cards under the main head or any of its subdivisions to classify cements (as Portland, Natural, Puzzolan, Sand). Treatment letter T may be used before any of the file numbers to separate tests from statistics or other information based on tests.

19.0 AGGREGATE—Sand, gravel, stone — General. (Classify samples, etc., by locality.)

20.0 GROUT, General, Machinery and Methods.

21.0 MORTAR, General. Tests, etc., showing effects of various sands or screenings on mortar, to be filed here. Tests on mortar made from standard sand to be filed under 18.0—Cement.

22.0

23.0 CONCRETE, General. (File data on waterproofing materials under waterproofing—26.0. Use treatment letters to separate tests, statistics, etc. See definition of treatment letters T and B.

24.0 GENERAL THEORY OF HYDRAULICS.

25.0

26.0 WATERPROOFING (methods and materials). Paint, asphalt, bitumen, tar, pitch.

27.0 FIREPROOFING (methods and materials). Asbestos.

28.0 BUILDINGS—design, construction and alteration of buildings to be used for office purposes by the Board.

29.0 TIDES AND WAVES.

30.0

31.0 METERS AND GAGES (for electric apparatus, see 11.65, for hydraulic machinery, see 11.5, etc., rain gages, 2.2, etc.

32.0 GATES AND VALVES, General. (See subdivisions of 11.0 for specific cases.)

33.0 EXPLOSIVES AND BLASTING.

34.0 EARTH AND ROCK WORK, disposal of spoil (not in connection with some special structure).

35.0 CULVERTS.

36.0

37.0 METALS, General, welding, etc. (Classify by kind under any of the heads). Tests, etc., on steel pipe, or other structure, should not be filed here, but under the heading of these subjects. Cross-index sufficiently, however, to make all general information on metals, filed elsewhere, available here.

38.0 RETAINING WALLS (Not in connection with aqueducts or other structures).

39.0 DOCKS AND WHARVES.

40.0 SCOWS.

41.0

42.0 CARS.

43.0 WAGONS.

44.0 CAISSONS.

45.0 COFFER-DAMS (not for river control or any particular structure).

46.0 INTAKES AND HEADWORKS.

47.0 BRICK, TILES.

48.0 VITRIFIED PIPE.

49.0

50.0 TIMBER AND TIMBERING (General, see subdivisions of main structures).

51.0 PILES, steel, wood, concrete, sheet piling, etc.

52.0 PHOTOGRAPHS (letters of transmittal, etc., filed here), photographs, negatives, etc., are filed numerically by department and indexed by the entire subject list.

53.0 FENCES—General.

59.0 CIVIL SERVICE, General. (See Employees 72.3.)

65.0 IRRIGATION.

66.0 DISEASES (incident to water).

67.0 ICE.

69.0 INSPECTION.

70.0 BORINGS, test pits, soundings and shafts (not classified under Aqueducts or other heads).

71.0 TUNNELS.

72.0 ORGANIZATION AND ADMINISTRATION OF THE ENGINEERING BUREAU—GENERAL. Diagrams, etc. (use letters to designate departments, divisions, sections). 72.0 Headquarters, 72.08 So. Aq. Dept., 72.0NP No. Aq. Dept., Peekskill Div.

73.0 WEIGHTS AND MEASURES.

74.0 SURVEYING, General. (Not to include surveys done in connection with any special structure, but investigations of methods, etc., applicable to any part of the work. Surveys made for any particular structure, as reservoir, dam, aqueduct, building, railroad, etc., are to be filed under those heads, by the use of treatment letters and locality letter before and after the file number, respectively.)

Civil Service, 59.0, and organization, 72.0, have been included in the "main structures" because they played so important a part in the organization of the bureau.

In the first eleven subjects, watersheds, reservoirs, aqueducts, filters and distributing conduits follow each other in the logical order of their utility, while the others, as aeration works, water-power development, pumping and power stations, are more or less collateral in their relation to the former.

The principle of the subdivision of these "main structures" is probably most easily explained on the basis of cost. In estimating the cost of a structure, everything which its construction occasions is charged against it, either directly or indirectly through one of its parts. Similarly, everything likely to arise in the construction of a "main structure" has a place in the index under some subdivision of the integral number representing the main structure; the decimal file number shows it in its proper relation as a detail step by step back to the main structure. Under reservoirs, for example, the main subdivisions are 3.2, capacity and yield; 3.3, improvement in site; 3.4, dams and dikes; 3.5, main structure of distributing reservoir; 3.6 conduits and piping; 3.7, gate-houses not with dams; 3.8, incidental work; all likely to enter into the construction and design of a reservoir. The same is true of aqueducts and the other "main structures." It is apparent, therefore, that such subjects as railway relocation, highway relocation, excavation, etc., will have several file numbers, selection in any instance depending on which structure the data were made in connection with.

It should be noted that the "main structures" are what might be called "kinds" of structure, while their first subdivisions are in most cases "types;" for example, aqueduct is a "kind" of structure, while grade tunnel or steel-pipe siphon is a "type" of aqueduct. There is no connection between the number of decimals in the file number and "kind" or "type," for grade tunnel is 5.3 and steel pipe is 5.42. The intervention of the generic heading "siphon," which in itself is a "type" of structure is responsible for the extra decimal place in steel pipe, pressure tunnel, etc. "Kind," or "types," therefore, may be found throughout the list regardless of the number of decimal places. The distinction between "kind" and "type" is one of function. "Kinds" have different functions and "types" the same function.

The remainder of the index (the general subjects) consists of a list of subjects pertaining to engineering methods, articles, materials, investigations on which are general though they may be "made in connection with" some main structure. Examples are cement, grout, aggregate, asphalt, cars, caissons, brick, etc.

The computers and the engineers are instructed to distinguish between general data "made in connection with" a structure and data that are of value only in conjunction with some definite

structure, in order that the results of their investigations may be so filed that they will be readily available for use by others engaged on similar work.

In the alphabetic or a to z index,* some subjects have the same file number when used generally as they have when considered as subdivisions of a main structure; for example, steel pipe, 5.42, is a subdivision of aqueduct siphons. Steel pipe, general, however, has the same file number, regardless of the fact that the steel pipe may not be for siphons. This has been done to avoid duplication of file numbers, the theory being that the locality letters would separate data on siphons from general data on steel pipe. This may seem illogical in some cases; however, it is far better to accept the system as applied to general and miscellaneous matter, merely as an arbitrary set of numbers corresponding to certain topics, and resolutely dismiss rigid ideas of logical sequence and consistency, except in the case of data relating to "main structures," wherein the logical arrangement can be closely followed.

The list is manifestly incomplete in considering isolated topics, and as a general principle it will be found better to classify subjects under heads already given than resort to the continual addition of integral numbers. The alphabetic index will guide those uninitiated in the classification that has been followed.

The subject list constitutes a rigid *mold* into which the subject matter must be cast as far as possible, hence the necessity for its being generally understood. For ease in consulting, therefore, two arrangements of the index are given, first the numeric or classified index arranged by file numbers from 1 to n, showing subjects in their proper relation to each other, regardless of any alphabetic arrangement, and containing such notes and explanations that have been considered necessary; and second, the alphabetic index arranged from A to Z. The latter is similar to Dewey's relative index. Every subject, however unimportant, in the 1 to n list, together with cross-reference and synonyms, is given here alphabetically with its file number; for example, a man seeking information on sand does not have to know that it has been classified under aggregate, 19.0. If he looks in the alphabetic index under sand he finds 19.1 in heavy-faced type. The type indicates that sand is further subdivided. If he enters the numeric index under 19.1 he finds all the subdivisions of sand in their proper relation to each other. The same subjects appear in both indexes with the same file numbers, with the exception that cross-references and synonyms are given in the alphabetic index, while none appear in the numeric index, so that the distinction is one of arrangement and function. The alphabetic index enables one unfamiliar with the classification to locate or file data, and it also enables librarians and file clerks to classify like data always under the same head. The alphabetic index would be used by the uninitiated, while the numeric index would probably be preferred by those thoroughly familiar with the system.

Numbers 1.0, 2.0 and 3.0 of the classified or (1-n) index are given here in full. The remaining numbers have been abridged to economize space.

Only a small portion of the alphabetic (A to Z) index is printed. There are at present over 1,800 subjects in this index.

TREATMENT AND LOCALITY LETTERS.

The file numbers are made up of three parts. First, the integral number with its decimals, representing the subject; second, the "treatment" letter, which precedes the file number and represents the point of view or phase of the subject under consideration; third, a "locality letter" following the file number, which serves to tie or identify the structure with one particular locality, department, etc.

The effect of the "treatment" and "locality" letters on the subject may be illustrated by Fig. 1.

*Here omitted.—Ed.

Locality letters are abbreviations which are decided upon from time to time as conditions demand. There may be a capital letter, or a capital and small letter; for example: A = Ashokan, Cn = Croton. Whenever two or more capitals are used they represent two or more structures, and modify the parts of the file number proper independently from left to right.

The following is a complete list of the "treatment" letters, with full explanations for their use:

"TREATMENT" LETTERS for *field and office* work, to be used before file numbers, in filing correspondence, field notes, plans, computations, etc.

Capital and small letters are given for the same definition. The small letters are used on notes, etc., made in the field, while the capitals are for office use, in order to show without further explanation, in referencing, whether a field or office note, or computation is referred to. In the case of plans and correspondence, which are always office products (plane table work and sketches excepted), capital letters are uniformly used, and not the small letters.

Where note appears with any treatment letter stating that it may or may not be used, with any of the classes of data to be filed, namely: plans, computations, correspondence, etc., the notes are provisional in so far as no cases have arisen that would make their use apparent. When any such cases do arise, attention of headquarters should be called to them, so that the change may be made uniform for all offices.

TREATMENT	SUBJECT	LOCALITY		Treatment Letter	File Number	Locality Letter
General	Dams	General			3.4	
Design	"	"		D	3.4	
Inspection	"	"		T	3.4	
General	"	Olive Br.	Ashokan Res.		3.4	AO
Design	"	"	"	D	3.4	AO
Borings	"	"	"	G	3.4	AO
Estimated cost or time of construction	"	"	"	P	3.4	AO
Bibliography "Foreign"	"	Muscoot. (of Croton reservoir but not so filed)		B	3.4	M

It should be noted that "foreign dams" are not filed with their reservoirs as are the Board of Water Supply dams (Note bearing on similar cases of foreign data.)

Fig. 1. Examples of "Treatment" and "Locality Letter," Filing System of New York Board of Water Supply.

"Correspondence" is used here broadly to indicate any matter—letters, reports, etc.—that is filed in the vertical 8½ × 11-inch file.

The word "foreign" is used in reference to works not under the jurisdiction of the Board.

F. FIELDWORK: Trignometric and other *office computations based on field notes*, for use in laying out work, or making fieldwork available for subsequent use in either the office or field, study or design, or construction. Subdivide by field treatment letters, if desired. Data taken from the field notes should be referenced on office computation sheets by file number, with the small letter showing the nature of the field note prefixed: as 1 5.0 C is a reference on an office computation to a field note, of a landtaking survey on the Catskill Aqueduct. The computation sheet on which this reference appears would have the file number Fl 5.0 C.

As a general thing office computations will be on 8½ × 11-in. sheets, and field notes on 5 × 8-in. sheets. The small letters, therefore, will appear before file numbers on 5 × 8-in. sheets, and the capitals before file numbers on 8½ × 11-in. sheets.

Fl. 5.0 C. Office work, or computations on landtaking survey notes on aqueduct.

F△ 3.0 A. Office work, or computations on Ashokan Res. triangulation field notes.

D. STUDIES AND DESIGNS: Including computations of ideal quantities and costs per foot; also including *estimates of cost for use in comparing alternative schemes*, or comparing alternative types of construction, locations, or designs of a structure. May be used for filing plans, computations, and in correspondence file for reports and letters. Brown paper or other plans that constitute studies or designs will have this letter prefixed to the subject file number. This will serve to separate the study drawings from topographic plans of the same structure, the latter having the prefix (Z) before the file number.

When topographic plans have lines interpolated, showing the probable location of an aqueduct line, dam, or other structure, they then become studies of location and should have the treatment letter (D) before the file number. Such drawings as a rule should be re-accessioned as the added lines have altered the drawings from their original descriptions on the accession sheets. The original topographic plans which show a broad strip of country in the general vicinity of the above mentioned location, will have the prefix (Z) before the file number.

Contract drawings will be filed by contract, and may have either (Z) or (D) prefixed, if desired. Cont. No. 2, 5.2 C is the file number of plans for cut and cover sections of the Catskill aqueduct, Contract No. 2.

Plans of a general nature that could be used for subsequent contracts, but were "made in connection with" some particular contract should be filed in a "Contract General," or "All Contract" file and cross-referenced under the specific contract which they were "made in connection with."

P. PRELIMINARY ESTIMATES: Calculations [illegible] on a scheme, structure or section of work [illegible] the type of construction is already determined [illegible] assumed, for the purpose of finding its [illegible] cost *for financial purposes*; not for [illegible] designs. (The engineer's formal estimate [illegible] is computed by items just as they appear [illegible] contract, is put below. See E.)

P may be conveniently used in some [illegible] for estimates of time as well as cost; as for [illegible] in the correspondence file a report on the [illegible] time and sequence of letting contracts, or [illegible] timate of the time of completion of the [illegible] tunnel. (P may be used for computa[illegible] correspondence). The phrase "for financial purposes" constitutes the difference between [illegible] (D). Data for a Comptroller's estimate, [illegible] ample, should have (P).

p. MEASUREMENTS for PARTIAL ESTIMATE.

E. CONTRACT ESTIMATES: Includes the form[illegible] liminary, engineer's estimate, and all [illegible] for payment. Not used ordinarily for [illegible] correspondence.

L. LAND TAKINGS AND DAMAGES. REAL ESTATE, ETC: Used for plans, computations and correspondence, on the main structures to be [illegible] by the Board.

l. LAND TAKING SURVEYS.

T and t. TESTS AND INSPECTION: Also [illegible]ments. (T) used for plans, computations, correspondence, laboratory work, tests, experiments and laboratory records. Statistics or records of foreign work have the prefix (B) in preference to (T), or if it appears desirable, (B) may be subdivided by (T) as BT 18.33, a foreign comparative test on cement, but in filing, the (B) should be given the precedence, that is, filed by (B) first and then under that by (T) or other treatment letter.

G and g. GEOLOGY AND UNDERGROUND INVESTIGATIONS: Includes borings and test pits, etc. (G) may be used for plans, computations, correspondence, etc.

K and k. COST, BY FORCE ACCOUNTS on Board of Water Supply Work. Cost on other works see (B). Not ordinarily used for plans or correspondence. Use (k) for field data.

B. BIBLIOGRAPHY: Includes all information in regard to "foreign" works gathered by members of the Board of Water Supply force, or outside data made by outside people. Used for computations, correspondence, drawings. This letter is applied to foreign data only, and it takes precedence in the order of filing over any of the other letters the use of which might be indicated in any particular case. For example, a record of borings on the Pennsylvania tunnels could have the file number G 71.0 (71.0 = tunnels, General), according to the definition of (G), but it is better to use (B) in order to separate foreign boring data from that originating in the Board's offices, and 70.0 (70.0 = borings, general) instead of 71.0 as the data collected was for general information on borings regardless of their relation to tunnels. If sufficient information is collected on any of the subjects, it might be advisable to subdivide (B) by the other letters, as BG, foreign geologic information, etc. Always file by (B) first, however.

S. SPECIFICATIONS: Used before file number of materials or structures, not before 72.12 or 72.15. Not ordinarily used for plans or correspondence.

△ TRIANGULATION: May be used for plans if desired. Not ordinarily used in correspondence file.

Z and z. TOPOGRAPHY: Topographic surveys for any structure. Use (Z) on topographic plans. See definition of D.

bl. BENCH LEVELS.

y. LINE AND GRADE FOR CONSTRUCTION.

R and r. RECORD MEASUREMENT: On completed work including measurement for final estimate.
(R) may be used for record plans.
(Fr) for record computations, etc.

ORDER OF FILING AND NATURE OF FILES.

The order of filing by parts of the file number, and the number of decimals to be used, will depend on the data to be filed and, to some extent, on local requirements. Correspondence and plans, for example, are necessarily more general than a computation, so that it is not necessary or desirable to use many decimal places in these files. For example, in writing about siphon chambers, 5.46, all the subdivisions may properly be discussed in one letter. Therefore, in the correspondence file, 5.46 would be the only folder for siphon chambers. It would be a hardship to require a man to split his correspondence by the finer subdivisions. Likewise, one plan may properly show all the details of a siphon chamber, and could not be filed except in 5.46.

Summaries, of course, are necessary, and will be filed under the general numbers, but the parts that go to make up a summary should be segregated as much as possible so that they can be filed under the subdivisions of the subject under discussion. It should be observed that the closer we approach the decimal point, the more general is the heading, and with some classes of data it is perfectly legitimate to disregard the subdivisions, while in others, computations, for example, the subdivision should be followed. An abridged list in pamphlet form has been arranged for correspondence.

For discussing the filing of data by parts of

the file number, three classes of files may be recognized:

(1) GENERAL FILES.—Data in which do not depend for their value on one particular structure or locality, or any special set of conditions. A computation on weight per foot of riveted steel pipe of different sizes would be a perfectly general computation.

(2) SPECIFIC OR STRUCTURE FILES.—Data apply specifically to some structure or locality by name. A computation on the lining of a pressure-tunnel siphon to be used at the Hudson River crossing is an example of a specific computation.

(3) CONTRACT FILES.—Data which refer to some contract by number. Contract files are limited in their scope by the physical limits of the contract, by a date from which they were started, and by the nature of the work to be performed.

Each of these classes of file indicates a different order of filing by parts of the file number as follows:

I.—GENERAL FILES:
(1) By "kind" of structure, or subject.
(2) Under each "kind" by "type."
(3) Under each "type" by "treatment" or phase, as bibliography, design and geology.
(4) Under each treatment by the decimal subdivisions of "type."

A general file would be arranged as follows on this scheme:

2.0 Watersheds ("kind" of structure).
3.0 Reservoirs ("kind" of structure).
5.0 Aqueducts ("kind" of structure).
5.3 Grade tunnels ("type" of structure).
B5.3 "Foreign" information on grade tunnels ("treatment" or phase).
B5.323 "Foreign" information on lining of grade tunnels (subdivision of "type").
D5.3 Design of grade tunnels ("treatment" or phase).
D5.321 Quantities per foot, standard sections (subdivision of "type").
D5.322 Excavation, standard sections (subdivision of "type").
D5.323 Lining, standard sections (subdivision of "type").
G5.3 Geology of grade tunnel ("treatment" or phase).
5.4 Siphons ("type" of aqueduct).
5.42 Steel pipe siphon ("type" of aqueduct).
B5.42 "Foreign" data on steel pipe ("treatment" or phase).
D5.42 Design of steel pipe siphon ("treatment" or phase).
D5.4222 Capacity and hydraulic elements (subdivision of "type").
etc.
6.0 Filters ("kind" of structure).
etc.

II.—SPECIFIC OR STRUCTURE FILES:
(1) By "kind" of structure as reservoir, aqueduct, filter, etc.
(2) Under each kind by "type" as cut-and-cover aqueduct, grade tunnel, steel pipe siphon, etc.
(3) Under each "type" by the localities where that "type" has been used or considered; as grade tunnel at Garrison, Cat Hill, etc. Steel pipe siphon at Peekskill Creek, Hunter's Brook, etc.
(4) Under each locality by "treatment" or phase; as design of steel pipe siphon at Peekskill Creek, etc.
(5) Under each treatment by decimal subdivisions of "type" as leakage of steel pipe siphon, excavation for steel pipe siphon, etc.

A specific or structure file would then appear as follows:
5.0 Aqueducts ("kind" of structure).
5.3 Grade tunnels ("type" of structure).
5.3CG Catskill aqueduct, Garrison tunnel (locality).
D5.3CG Design of Garrison tunnel ("treatment" or phase).
D5.321CG Quantities per foot (subdivision of "type").
D5.322CG Excavation (subdivision of "type").
etc.
5.3CCh Catskill aqueduct, Cat Hill tunnel.
D5.3CCh Design, Cat Hill tunnel.
D5.322CCh Excavation, Cat Hill tunnel.
etc.

III.—CONTRACT FILES:
The order of filing here will depend on what it is desired the contract file should show, that is, it would depend on the classification of accounts on the contract or the splitting up of the contract into parts on which it is desired to keep the cost. A suggestion is as follows: for example, take a contract that includes a stretch of aqueduct ("kind" of structure) composed of a stretch of cut-and-cover ("type" 5.2), a grade tunnel ("type" 5.3), a steel pipe siphon ("type" 5.42), and a pressure tunnel ("type" 5.43). The arrangement would be as follows:
(1) By contract numbers 1, 2, 3, etc.
(2) Under contract by "kind" of structure, as Res. Ag., etc.
(3) Under "kind" by "type," cut-and-cover, grade tunnel, pressure tunnel, etc
(4) Under each "type" by natural subdivisions or parts on which it is determined to keep the cost.
(5) By decimal subdivisions under each "type," or under each part of work on which it has been determined to keep the cost, or under each "type" or "part" by item of the contract. For example, it might be decided to keep the cost on a certain stretch of cut-and-cover aqueduct between stations 100 and 200 and also on a culvert at station 125. The arrangement would then be looking down the file Contract No. 2 ("kind" of structure), aqueduct 5.0, 5.2 ("type" of aqueduct). Cut-and-cover stations 100-200. Under cut-and-cover, culvert at station 125, and the latter split by the various items of the contract that enter into its construction, as item 15, excavation; item 17, refill; item 12, concrete, etc. Another stretch of cut-and-cover aqueduct between stations 300 and 400 might be divided in exactly the same way. The application of the system to estimates and force accounts has intimate bearing on the arrangement of contract files.

As previously noted "kinds" and "types" will be found throughout the list regardless of decimal place, but wherever found, the above orders of filing should be followed.

ESTIMATE AND FORCE ACCOUNT.

The method of filing or segregating data by item and file number admits of two possibilities: the division of the item by file number and the division of the file number by item. Under cut-and-cover aqueduct, for example, the file number for excavation is 5.23 and it may be further subdivided under a contract (as 5.23, item No. 1, excavation in rock; and 5.23, item No. 2, excavation in earth). Again, under grade tunnel excavation, 5.33, item 34, reads: "enlargement tunnel section in earth;" item 34 covers this work. Conversely, a given item of concrete or excavation may be split up by file number and apportioned among several structures or parts of the work. For example, item No. 6 for concrete may be distributed among several structures as culverts on cut-and-cover aqueduct.

When it is considered that a contract is, as a rule, for one class of work represented in the index by a single file number, as aqueduct 5.0,

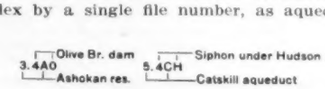


Fig. 2. Further Illustration of the Use of "Locality Letter," Filing System of New York Board of Water Supply.

which may or may not be subdivided sufficiently to accommodate a large amount of correspondence and other data that is certain to accumulate during its pursuance, it is a decided advantage to file by item in the contract files. Abstractly, it is quite immaterial whether the segregation is accomplished by file numbers representing topics or by items representing identical topics, the advantage lying with the latter method in that file numbers for details may be curtailed without sacrificing minute subdivisions in the contract files, where data on detail accumulate rapidly.

Moreover, the definition of a given item becomes fixed in the minds of those engaged on contract work, and, therefore, it is not an unnatural division or an unusual line along which to require them to think. On the contrary, field men will find it a distinct advantage in contract work generally to avoid a duplication of file numbers and items and the consequent necessity of memorizing a confusing relation between them which otherwise would be the inevitable result.

The usual method of requiring engineers in charge of construction to report merely quantities applicable to making up preliminary or final estimates sacrifices a great deal of information in regard to the real cost of structures, which, in consequence, is never altogether obtained. For exauple, a contract quantity of concrete in a given item may contain concrete used in different structures stretching over several miles within the limits of a contract, and earthwork likewise is often lumped in one item, although it occurs in connection with many structures. Computations for the estimate quantities must invariably be made for the different structures and kept separate, and these partial sums are always brought together in a more or less orderly way to make up the total of the item.

In planning the subdivisions of the main structures natural divisions of the structures or works were borne in mind in order that a separation of the information and costs in accordance with the subjects would give information of interest and value, and it is proposed that the engineers in charge of construction report to headquarters not on the total quantities for each item, but on the partial quantities divided in accordance with such a portion of the list of subjects as is manifestly applicable to the work in question.

ORGANIZATION FOR FILING WORK.

The two essentials to uniform filing are a uniform rule or subject list for classification, and a unit interpretation for its application. With any subject list, however well defined, may be its parts, legitimate differences in interpretation will arise with different individuals, so that it may be stated, as a general principle, that indexing and filing should be entrusted to as few people as conditions will permit.

The first factor, namely, the subject list, having been chosen, there remained the necessity for an organization that would keep files, indexes and practice in widely-separated offices uniform. One man in each office is assigned the care of the files and in matters of filing and indexing he reports to the assistant engineer in charge at the headquarters office. He should refer all questions of doubt as to interpreting index, additions, changes and corrections, therein, to the headquarters office, and under no circumstances should changes take place without sanction. Each office is supplied with as many copies of the subject list as it requires. Each copy is numbered and charged at headquarters to the man in charge of filing in the office to which it is sent. He is responsible for keeping all such copies up to date. Additions and corrections are transmitted in duplicate and he is required to return a signed statement to the effect that the changes have actually been made in the subject lists in his charge. He is also required to examine file numbers put on plans and computations by the engineers and on correspondence by stenographers. In headquarters office file numbers on correspondence are put on by one person and letters from other offices are also seen by him, so that if a change of file number is made on a letter or other document the office from which it comes is notified so that they can change their copies.

The natural tendency of the individual, especially if he has not been schooled in a large organization, is to regard files as a personal matter, and one of the first and most important things to be done before any filing system can work satisfactorily is to secure cooperation with the filing force. This is indeed a difficult as well as a diplomatic task, for much of the ultimate success and good feeling toward the filing system will depend upon the personnel of the filing force; various objections and prejudices must be overcome, and it is much easier to make an enemy than it is to secure a friend of the filing system in the effort.

Many card indexes and routines are necessary to carrying out the details of the organization which it is not within the province of this article to describe, but it is hoped that the foregoing suggestions will prove sufficient, at least as a mode of procedure, to those confronted with a similar problem.

TRADE BETWEEN THE UNITED STATES AND Germany for the years ending June 1, 1907 and 1908, is compared in tables prepared by the Bureau of Statistics of the Department of Commerce and Labor. The items of greatest interest to the readers of this journal are as follows:

The total exports to Germany for 1907-8 show an increase of $20,314,440 over those of 1906-7, while the imports have decreased $18,608,000.

Articles Imported from Germany.		1907.	1908.
Automobiles	Nos.	61	32
	dolls.	272,062	124,747
Cement, Roman, Portland, etc.	lbs.	413,969,859	218,794,855
	dolls.	1,303,281	726,513
Copper pigs, bars, ingots, etc.	lbs.	6,636,210	4,417,815
	dolls.	1,128,932	710,908
Pig iron	tons.	32,504	2,096
	dolls.	869,207	61,741
Articles Exported to Germany.		**1907.**	**1908.**
Automobiles, and parts of	dolls.	155,623	178,914
Coal, bituminous	tons.	5,053	8,957
	dolls.	16,916	28,473
Copper ingots, bars, etc.	lbs.	91,016,167	134,987,671
	dolls.	19,790,189	19,750,769
Electrical machinery	dolls.	105,793	100,930
Metal-working machinery	dolls.	2,245,364	1,935,468
Pipes and fittings	lbs.	898,203	1,142,114
	dolls.	36,463	49,697

RECONSTRUCTION OF STREET RAILWAY TRACK AT CHARLOTTE, N. C.

For street railway track construction in paved streets a very general practice is to use deep girder rails with either grooved or tee heads, and to lay these directly upon the concrete foundation. In some cases ordinary railway rails are used. The rails are usually laid upon ties 10 to 12 ft. apart, which serve to support them while the concrete is being laid beneath them. These ties are embedded in the concrete. Examples of both of these systems were shown in our issue of Nov. 7, 1907.

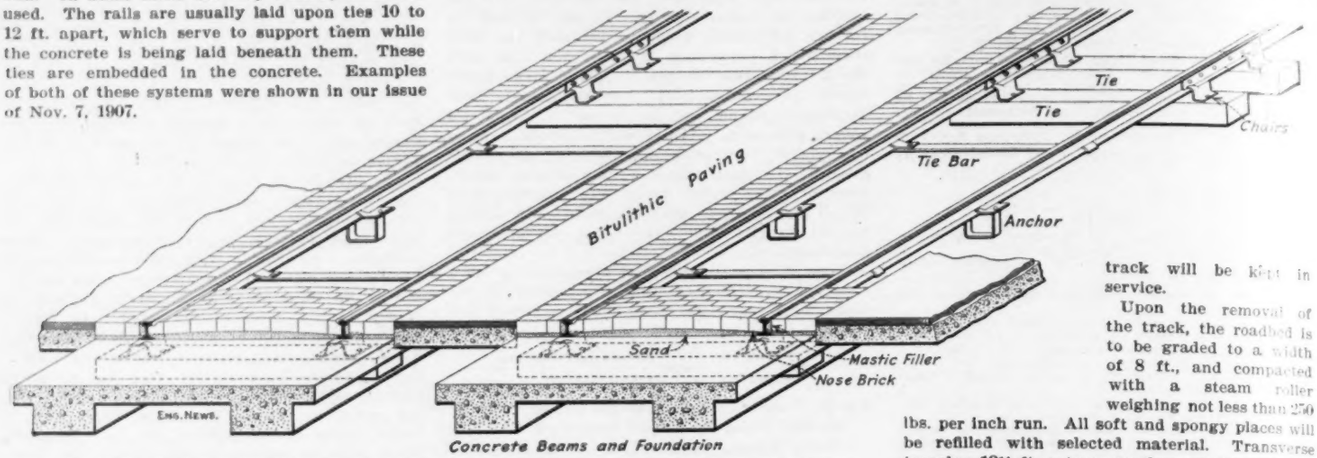


FIG. 1. NEW STREET RAILWAY TRACK FOR THE CHARLOTTE CONSOLIDATED CONSTRUCTION CO.; CHARLOTTE, N. C.

James Nisbet Hazlehurst, M. Am. Soc. C. E., Consulting Engineer, Atlanta, Ga.

The cost of girder rails is generally from $8 to $10 more than that of ordinary rails, but the use of the latter in paved streets sometimes presents difficulties on account of the shallow depth of the rail, and the consequent small cover of concrete over the ties if brick or stone paving is used. These difficulties may be obviated by reverting to the old practice of supporting the rails on chairs, and such a system has been adopted in the reconstruction of the lines of the Charlotte Consolidated Construction Co., which owns the street railway, light and gas plants of Charlotte, N. C. The system was designed by Mr. James Nisbet Hazlehurst, M. Am. Soc. C. E., of Atlanta, Ga., as consulting engineer to the company. We are indebted to him for information and drawings, and he states that the results are satisfactory to the company and to the city engineer. The general construction is shown in Fig. 1.

The track is laid with 80-lb. rails of the Am. Soc. C. E. section (5 ins. high), in 60-ft. lengths. These are laid upon wooden ties during construction, until supported by the concrete beams. The ties are used at the rail joints, and at intervals of 12½ ft., and have iron chairs to carry the rails. Between the ties, the rails are anchored by iron stirrups embedded in the concrete. The rails are connected at intervals by flat tie-bars.

The special features to which Mr. Hazlehurst calls attention are the chairs, the tie-bars, the anchors, and the longitudinal expansion joint for the paving. These details are shown in Fig. 2. The purpose of the chair is to put the wooden ties low enough for a proper thickness of concrete between them and the paving. They are spiked to the ties. The tie-bars hold the rails by the base instead of being passed through holes in the webs, as is the usual way when high rails are used. Each end of the bar is bent to engage the outer side of the rail base, while the inner side is held by a lug or clamp bolted to the tie-bar. A slotted hole in the bar enables the position of the clamp to be adjusted.

The anchor consists of a steel tie-plate, having riveted to it a rectangular frame or stirrup which is embedded in the concrete. The tie-plate holds the rail by lugs which are formed by slitting and pressing the plate, as shown. These anchors are placed at intervals of 6¼ ft. Their general design is similar to that used for the street railways at Indianapolis, and illustrated in our issue of Nov. 7, 1907. In the latter case, however, a combination rail-brace and tie-plate is used (on ties and for anchors), thus avoiding the necessity for using tie-bars or tie-rods. Bolts passed through the tie-plates carry anchor plates, and the rails are thus rigidly anchored to the concrete. The purpose of these anchors is to resist the tendency of the brick paving to arch and rise from the sand cushion when expanding under the influence of heat. At Indianapolis there are two anchors between each pair of ties, the ties being spaced from 10 ft. to 12 ft. apart.

The city of Charlotte had let contracts to the Atlantic Bitulithic Co. for about 30,000 sq. yds. of pavement. The railway company, under its franchise, had the right to select the material for paving along the tracks and for 14 ins. outside the rails. Mr. Hazlehurst adopted brick for this purpose. The groove or nose bricks are stretchers, and a line of stretchers is laid on the outside of each rail. These latter, however, are not butted against the rail in the usual way, but are ¾-in. from the rail head. An asphaltic composition is filled between the rail and the brick, thus forming longitudinal expansion joints in the pavement. With double tracks there are four of these expansion joints.

METHODS OF TRACK RECONSTRUCTION.—The specifications for the work of track reconstruction require that only one line of track shall be disturbed at one time, and for a distance of not more than two city blocks. The opposite track will be kept in service.

Upon the removal of the track, the roadbed is to be graded to a width of 8 ft., and compacted with a steam roller weighing not less than 250 lbs. per inch run. All soft and spongy places will be refilled with selected material. Transverse trenches 12½ ft. c. to c. are then cut for creosoted ties 6 × 8 ins., 7 ft. long. Selected material from the street surface is tamped under the ties by rammers weighing not less than 20 lbs. Upon the ties are placed the chairs. The rails are then laid, with square joints spliced by angle bars (the drawing in Fig. 1 shows plain splice bars). The tie-plates, anchors and tie-bars already described are then put in place. The track is then lined and surfaced.

Under each rail is dug a trench 20 ins. wide and 9 ins. deep, on the outside of which (and against the ties) are set 1-in. planks supported by temporary stakes. These are for the concrete forms. Similar planks are set 14 ins. from the outside of each rail, and to such a height that the 5-in. bed of concrete forming the base of the pavement will

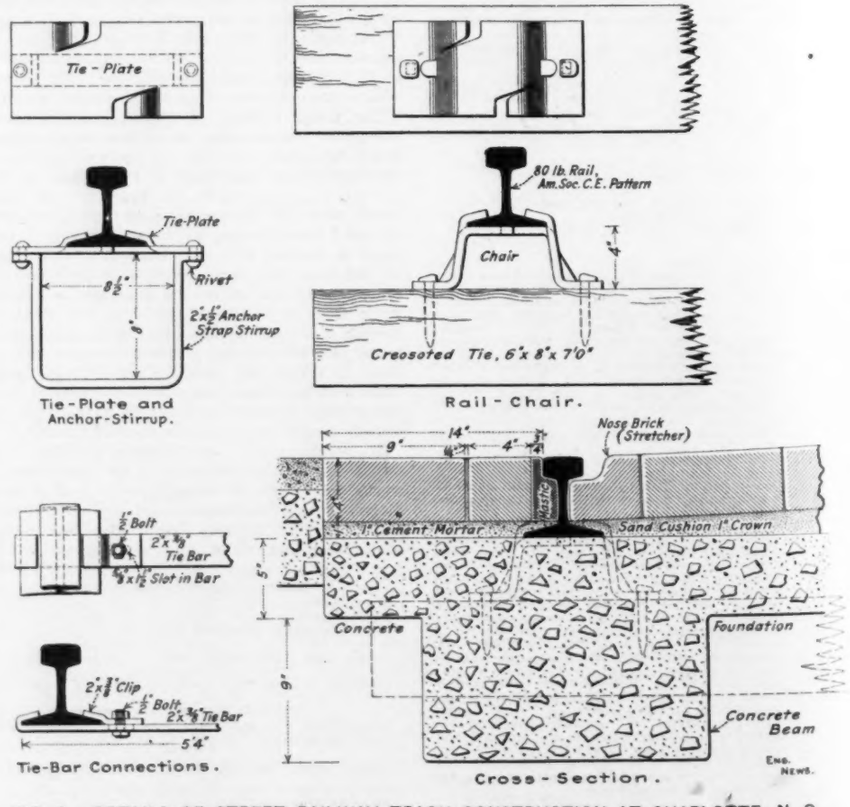


FIG. 2. DETAILS OF STREET RAILWAY TRACK CONSTRUCTION AT CHARLOTTE, N. C.

extend to within 5 ins. from the top of the rails. The concrete is a 1:3:6 mixture (using broken stone), mixed either by hand or by machine. Upon the concrete a 1-in. layer of 1:2 mortar is laid for 14 ins. on the outside of each rail, and the paving bricks are laid directly upon this. Between the rails, a cushion bed of sand is laid, and is dressed by a template to give a crown of 1 in. at the center. The paving bricks are laid upon this bed.

Expansion joints ¾-in. wide are provided along the rails and at intervals of 75 ft. across the pavement. These are filled with a composition of 15% pure asphaltum and 85% finely-ground mineral dust, mixed and heated upon the work. If this should not have the proper plasticity, the asphalt may be increased to 25%.

When the brick paving is laid and the expansion joints are filled, the pavement is to be rolled with a steam roller. A grouting of cement and sand 1 to 2, mixed to the consistency of cream, is then brushed over the surface with rubber-tipped floats to fill all spaces between the bricks. After this a thin coat of sand is sprinkled and left for a time, being removed by the contractor as required.

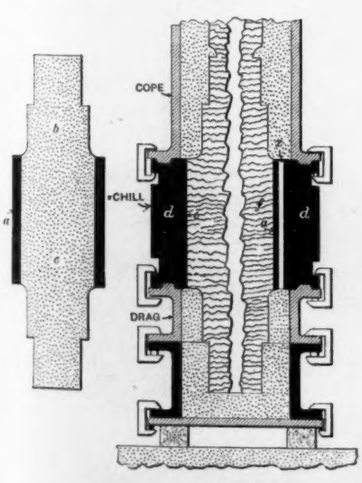
The contract for the first part of the work was let to the Atlantic Bitulithic Co., of Richmond, Va., at the following prices: Taking up and relaying track (exclusive of bonding), 34 cts. per lin. ft.; removing and distributing 195 tons of rails, 90 cts. per ton; 1,336 cu. yds. of concrete beams and concrete street foundation, $2 per cu. yd.; laying 5,833 sq. yds. of vitrified brick paving (including expansion joints), 42 cts. per sq. yd. The company supplies all material except the lumber for the forms, the mastic for the expansion joints, and the water necessary for concrete.

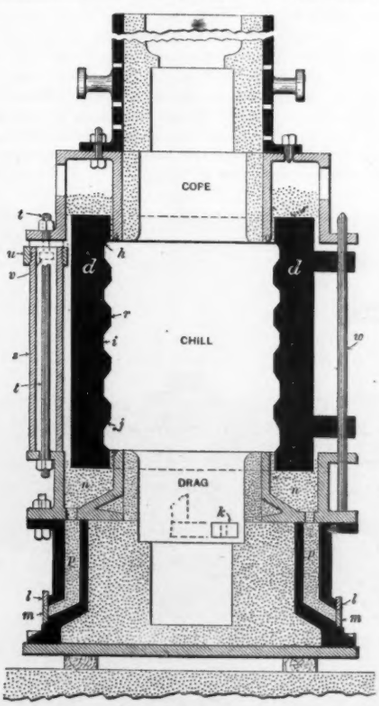
METHOD OF OBTAINING A TRULY CIRCULAR AND UNIFORM CHILL IN ROLLS.*

By THOMAS D. WEST,† M. Am. Soc. M. E.

The determination, by actual test, of the difference in strength of turned chill and sand-cast rolls of like diameters, both cast from the same ladle of metal, would be very valuable to engineers and manufacturers. So far as the writer is aware, no such tests have been made. It is reasonable to expect, however, that the strength of the sand-cast roll will exceed that of the chill roll, if both be cast from the same metal, especially if there be any variation in the thickness of the chill. This view will doubtless be shared by those who have had extended experience in the use of chill rolls.

In casting a chill roll the general conditions are as shown in Fig. 1. The metal in the outer part *a* (shown in black) will present a white appearance for a depth of ¼ to 2 ins. or more, while that in the necks and body, *b* and *c*, will be mottled or nearly gray. In *a* the carbon exists in the combined form, while in *b* and *c* it is largely graphitic. The fact that the shrinkage of the former in solidifying is considerably greater than that of the latter is an important consideration in the manufacture of rolls. If two test bars, under 2 ins. square in section, be cast from the same ladle, the one in an iron, the other in a sand mold, the shrinkage of the former will be about twice that of the latter. This is shown by tests made by the author treated more fully in his "Metallurgy of Cast Iron" (pp. 413-415).





A METHOD OF OBTAINING A CIRCULAR AND UNIFORM CHILL IN ROLLS.

When a chill roll mold is being filled with metal the cooling qualities of the chill *d*, Fig. 2, cause the outer body of the inflowing metal, as it comes in contact with the chill face *e*, to solidify so rapidly that a contracting crust is formed in two to five minutes, according to the diameter of the roll.

The formation of the sustaining crust is easily explained as follows: On the side *e*, Fig. 2, the metal is shown as it fills the mold, while on the opposite side *f* the conditions that exist two to five minutes after the roll is cast are indicated. It is seen that the chill *d* has ceased to offer any support to the crust *a* by reason of the space created at *x* and that the chill *d* might be removed, so far as the body of the roll is concerned, if that were practicable. It is also evident that the metal inside of the crust *a* and the necks of the rolls is still in almost as hot and liquid a condition as when first poured. Its fluidity may, in fact, be maintained for 20 to 60 or more minutes, according to the size of the roll. This condition serves to explain in large part the difficulty of obtaining satisfactory chill rolls. The thin, almost semi-molten, crust *a* must sustain, during the early period of the operation, the static pressure of the confined liquid metal. The result in obtaining a chill roll casting is affected by small variations in the level of the mold, the quality of the metal, the temperature in pouring, the catching of fins at joints or crevices in the face of the chill, the operation of feeding devices, etc. It is no wonder, therefore, that with a process so sensitive and difficult to regulate that the losses range from 10 to 30% of the nominal output, by the systems now in use, and that the rolls cast in this manner are rarely truly circular with a uniform thickness of chill.

Again, a buyer who accepts a roll of uneven thickness of chill and not truly round runs great risks of breakage. It is certain, at least, that such rolls cannot stand the rough usage and wear that may be expected of truly circular ones with a uniform thickness of chill.

For the successful casting of chill rolls the appliance should be such as to enable the chill *d* to remain constantly in intimate contact with the crust *a*, and that it be controllable likewise vertically to take care of the contraction in that direction. Numerous devices designed to overcome the evil effects of a contracting crust have been tried, but it is believed that none of these meet the requirements in anything like the same measure as the appliance represented in Fig. 3, which differs radically from anything previously attempted, and is the invention of the author's son, Mr. Ralph H. West, who has had considerable experience in the manufacture of chill rolls.

In the use of this device the action of the contracting crust was demonstrated in a way never done before, and it served to show what may be accomplished to insure a truly circular roll casting of uniform thickness of chill. To make this clear a detailed description of the operation will first be presented.

The chill *d*, Fig. 3, has grooves *i*, which are shown in an exaggerated form in the illustration. These grooves vary in height and number to suit varying requirements, and exhibit gradual variations from bottom to top in the inclination of the sloping surfaces *h* and *j* for the purpose of taking care of the vertical contraction of the solidifying crust. This serves to insure a close contact between the upper slope of every groove and the corresponding bead cast on the chill roll during the entire period of settlement to final rest, which is brought about in the following manner.

After the metal is poured through the swirl gate *k*, the band *l*—operated by a lever, not shown—is moved, which serves to bring holes in the band to positions opposite *m*, this action allowing fine sand and other flowable material to run out of the partitions *n* and *p* at any desired speed. The chill *d* is lowered by this action causing the sloping surfaces *h* and *j* to remain in intimate contact with the upper sloping surfaces of the beads cast on the chilled surfaces of the roll.

In the first roll cast by this device the chill commenced to settle in about two minutes after the pouring was finished, and in about seven minutes the grooved face *r* had slid over the bead face *i* thus giving direct indication of the internal action of the contracting chill crust, a matter never before accomplished.

In this device the outer diameter at the points *i* is such that when the roll is cold enough to be removed from the chill it can be hoisted out of the latter, or the latter off the roll, as may be desired. The body of the sample roll cast in this chill was 11 ins. in diameter and 14 ins. long. When put in the lathe to be turned it was found to be perfectly round and of an exact thickness of chill at all points of its circumference.

Five other devices differing in the form of the grooves and the method of insuring contact have been designed. In one case the chill remains stationary while the cope, casting and drag can be lowered. In another the crust is depressed. In a third the cope and casting settle into the drag, while the chill remains stationary. In some of these devices the grooves, or hugging faces, are so arranged that they remain in constant contact with the beads on the roll until the latter is removed from the chill or its molds.

Chill turners claim that the extra labor in turning up chill rolls to remove the slight projections or beads cast on the rolls by this system is, on the average, much less expensive than that required to turn up smooth-faced chill rolls that are not truly circular, manufactured by processes now in use in our chill roll foundries.

Returning to Fig. 3, the cope is supported from the drag independent of the chill by means of four wrought iron tubes *s*, bolts *t*, adjustable sleeves *u* and set screws *v*. Three or four long turned rods or pins *w* serve to center the chill and cope with the drag.

It is believed that with the above explanation those familiar with founding will readily understand the operation of the device and appreciate its utility. The system is expected to greatly change the present practice of casting chill rolls.

*Paper presented before the American Society for Testing Materials, Atlantic City Meeting, June 23-27, 1908.
†Thos. D. West Foundry Co., Sharpsville, Pa.

A SYSTEM OF AUTOMATIC SIGNALLING, worked entirely by electricity, is being installed on the Metropolitan Railway in London. The system is said to be less cumbersome than the electro-pneumatic one in use on the "Tubes." "Indian Industry and Power" states in the June issue, that the new system provides for the brakes of the train being at once automatically applied if a driver should pass a signal set at danger.

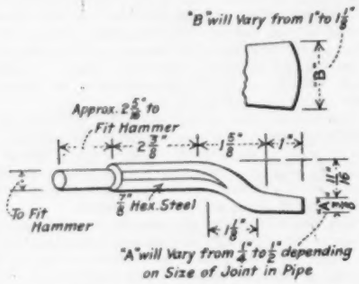
RAPID WORK AT PANAMA.—A Lidgerwood unloading record was made on Tabernilla dump on June 23, when the train crews with four unloaders plowed the spoil off 54 trains of 17 cars each, the total amount of material unloaded being 17,280 cu. yds. On this same day 52 trains were hauled to the dumps south of Pedro Miguel. On June 22, the Culebra Division loaded 1,719 Lidgerwood flats, and hauled 52 trains to Tabernilla and a like number south of Pedro Miguel.

The conductors and engineers hauling dirt trains between Culebra and Tabernilla are working hard to make three round trips a day over this 16-mile haul and load their own trains. The Superintendent of Transportation in the Culebra Division has maintained continuously that he had a sufficient number of engineers and crews in this service to move 50 loaded Lidgerwood trains a day to Tabernilla, provided the delays on the Panama Railroad main line could be eliminated. Since the work has been completed at Barbacoas bridge, not only this has been accomplished, but in addition one engine and crew have been diverted from this service, and yet 51 and 52 trains are moved daily. It is interesting to see these train crews trying to get to the best steam shovels in order to load quickly and pass other crews in the cut.—"Canal Record," July 1.

A PORTABLE COMPRESSED AIR PLANT FOR CALKING PIPE.

By A. E. WALDEN.*

In 1906 the Baltimore County Water and Electric Co. started to lay about 25 miles of 12, 10 and 8-in. pipe cross country to take care of a section that was supplied by deep wells which had given every evidence of failing entirely and prevented taking on additional consumers, and giving satisfactory service to consumers already connected. It was soon found that expert and rapid calkers could not be secured and a portable compressed air plant for caulking, cutting and drilling was purchased


"B" will Vary from 1" to 1⅛"
Approx. 2⅝" to Fit Hammer
2 3/16"
1⅝"
1"
⅜" Hex. Steel
To Fit Hammer
1⅛"
"A" will Vary from ¼" to ½" depending on Size of Joint in Pipe

Type of Tool Used with Pneumatic Hammer in Calking Pipe. Baltimore County Water and Electric Co.

and mounted on a truck, which proved a success in every respect, though some trouble was experienced with the gas engine. It was found possible to calk a 12-in. pipe satisfactory for 250 lbs. working pressure in 2½ minutes, the average for all joints being between three and five minutes. The joints were more satisfactory and were tight in every respect. The average actual time for hand calking on this size pipe was 30 minutes, but the all-day average was 45 minutes. At one time two men, with the air hammers, calked between 8 a. m. and 5 p. m. 76 lengths of 12-in. pipe out of a total of 87 pieces laid and leaded. This work was done in cold weather, which made it difficult to get the best results. This line is operating under pressures of from 100 to 250 lbs. per sq. in., depending on the elevation, and so far there has not been a joint leak where the air tool was used. The time required to cut 12-in. pipe was 2½ minutes. The portable plant was made up as follows:

A 6-HP. gasoline engine was belted to a small duplex air compressor capable of maintaining 70 to 80 lbs. air pressure when delivering 32 to 35 cu. ft. of air per minute, with storage and cooling tank and a small centrifugal circulating pump for circulating the water through the jacket. The engine was of the single cylinder vertical type, but it was found that a two-cylinder engine would have been better, and it is possible that one of the small, air-cooled, multi-cylinder, marine engines would have given the best results. The equipment was mounted on trucks, and provided with two lengths, of 150 ft. each, of ½-in. air hose connected to a storage tank at two different points so that it would only be necessary to move the machine once in every 300 ft. An air-hammer drill was provided operated from the same equipment capable of drilling up to 4-ft. holes. In the niggerhead formation it was possible to drill at the rate of 2 ins. per minute.

Two sizes of hammers for calking were purchased, one 3-in. and one 2-in. The 3-in. hammer was a success, as the shorter-stroke hammer jarred the operator's wrists so that they could not operate steadily. The proper shape calking tools could not be secured from the hammer manufacturers so that it became necessary to have them made up locally. These tools are shown in the accompanying figures. The cost of the entire equipment ready to operate was $665, including engine and truck, all tools, drills, hammers, etc. The usual antipathy of men toward labor saving devices was encountered but the results obtained demonstrated the possibilities of the equipment to do even better work than it did here. The same truck is now to be equipped with a small centrifugal pump for pumping out trenches, etc., and will thus make a very compact outfit. It was found that the construction of the hammer could be improved by providing a spring clip that would snap over a collar on the tool to allow of the tool turning easily in the socket, but so constructed that it would prevent jumping out when starting the joint. In calking where a joint "is poured" if the lead slug is driven in and swedged off (not cut off) with the tool no leaks will occur at a joint calked with the air hammer and it is possible to drive the joint hard enough to crack the bell.

*Superintendent and Chief Engineer, Baltimore County Water and Electric Co., Baltimore, Md.

MINIMUM RIVET PITCH IN PLATE-GIRDER FLANGES.

By C. H. WOOD.*

The minimum pitch which may be given to the flange-rivets in a plate girder having two lines of rivets connecting the flange-angles to the web is determined by the horizontal shearing strength of the web, and not, as commonly understood, by the mechanical limit of minimum c. to c. distance of rivets, generally taken at three diameters. This may be shown very easily by simple calculations of the stress conditions. Referring to Fig. 1, which represents a side elevation of part of the flange-angles with attached section of web,

p = minimum allowable alternate rivet pitch;
s = maximum allowable shear in rivets and in web plate, lbs. per sq. in.;
$2s$ = maximum allowable bearing of rivets on web plate, lbs. per sq. in.:
⅞-in. = diameter of rivets.
t = thickness of web plate, in ins.;
t (⅞ + ⅛) = horizontal area deducted from web by one rivet.

If we assume that the web does not carry any bending moment, as is generally done, the horizontal shear on the web along the inner gage-line in the length $2p$ is equal to the increment of flange stress in that distance, which is equal to the bearing value of two rivets in the web, or to the shearing value of two rivets in double shear, whichever is the greater.

The value of t that will give a bearing value equal to double shear for ⅞-in. rivets is $\frac{\pi}{4} \times$ ⅞-in. = 0.687-in. For values of t less than 0.687-in., the bearing value governs, and we have, equating the shearing strength of the web to the bearing value of two rivets,

$$(2p - 1)\ t\ s = 2 \times 2\ s \times ⅞\ t$$

whence $p = 2¼$ ins.

For values of t greater than 0.687-in. the rivet shear governs, and we have similarly,

$$(2p - 1)\ t\ s = 2 \times 2 \times \frac{\pi}{4} \times (⅞)^2\ s = 2.1\ s$$

whence, for t = ¾-in., p = 2.10 ins.
t = ⅞-in., p = 1.87 ins.
t = 1-in., p = 1.70 ins.

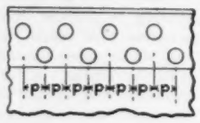


Fig. 1.

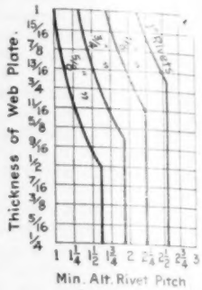


Fig. 2. Minimum Alternate Pitch for Flange Rivets of Plate Girders, as Varying with Thickness of Web Plate.
Bearing value of rivets on web governs in straight segment of curves.
Double-shear of rivets governs in upper segment of curves.

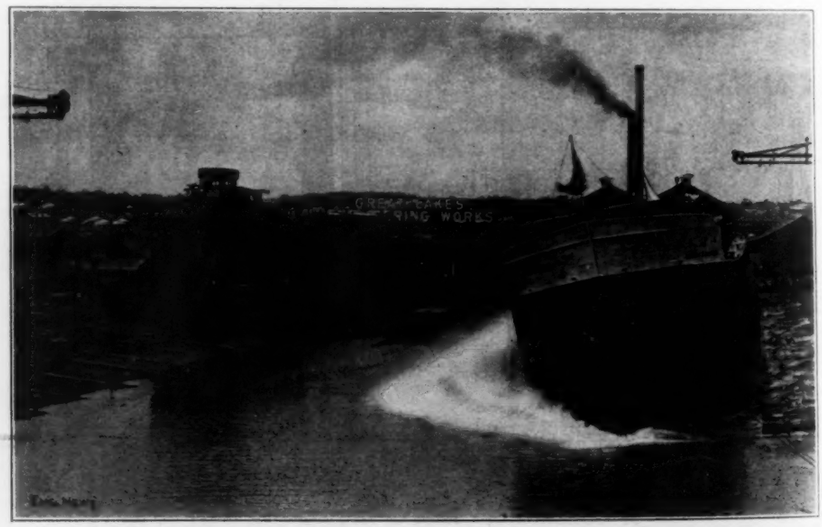
These results are shown graphically in Fig. 2 herewith, together with similar results for rivets of ⅝-in., ¾-in. and 1-in. diameter.

The writer has seen girders with ⅞-in. rivets and 1½ in alternate spacing at the ends. In view of the above discussion, such close spacing would seem to be bad design, and a source of weakness instead of strength.

*Structural Engineer, 186 State St., Albany, N. Y.

LAUNCHING AN ORE-CARRYING STEAMER.

In our account of the Detroit Convention of the American Society of Mechanical Engineers in our issue of July 2, we recorded the excursion down the Detroit River to the shipyards of the Great Lakes Engineering Works to witness the launching of a 12,500 ton ore-carrying steamer.



LAUNCHING THE ORE-CARRYING STEAMER "DANIEL B. MEACHAM" AT THE GREAT LAKES ENGINEERING WORKS, DETROIT, MICH., JUNE 25, 1908.

The accompanying photograph shows the vessel at the moment she slipped off the ways. The photograph was taken from the deck of the excursion steamer which carried the members of the Society, and which lay across the end of the slip into which the hull was launched.

REINFORCED-CONCRETE BRIDGES FOR TRACK ELEVATION ON THE ILLINOIS CENTRAL R. R.: FAILURE TESTS OF VERY LARGE CONCRETE SLABS.

The most recent development in the design of bridges for track-elevation work in Chicago is in the use of reinforced concrete. These structures are composed of rectangular slabs or beams of reinforced concrete, which are laid side by side to form a solid and self-sustaining floor. The Illinois Central R. R. is using bridges of this kind built entirely of concrete. The slab or beam construction was first used, however, by the Chicago, Burlington & Quincy Ry., with supports consisting of concrete abutments and steel intermediate bents.

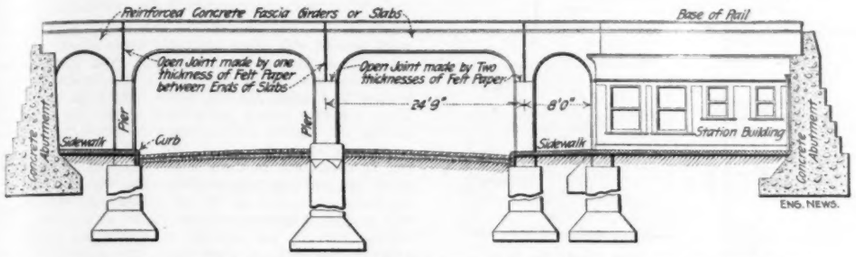


FIG. 1. REINFORCED-CONCRETE SLAB FLOOR BRIDGES FOR TRACK ELEVATION WORK; ILLINOIS CENTRAL R. R.

The concrete bridges of the Illinois Central Ry. are being used on its track elevation-work between 67th and 79th Sts. (Grand Crossing). On this part of the work there are eight tracks. The floor is covered with ballast, so that the ordinary track construction is carried unbroken across the bridges. The concrete slabs or beams are used in the manner above mentioned, but they are supported by abutments and intermediate piers (or bents) all of reinforced-concrete construction. Each bridge has two roadway spans 24 ft. 9 ins. c. to c. of piers, and two sidewalk spans about 8 ft. long from the center of the pier to the face of the abutment. At the middle of the street and inside each curb line is a wall or pier of monolithic concrete, with arched openings. Upon these and the concrete abutments rest the concrete slabs or beams. Along each side of the bridge are parapet or coping slabs which form the fascia girders and retain the ballast. Those for the sidewalk form arched openings, while those for the roadway spans have curved knee-brace extensions at the piers. This arrangement gives a better appearance than would be the case with the plain rectangular openings formed by the slab floor.

The general design of one of these bridges is shown in Fig. 1. At some of them a small station building of concrete forms a part of one of the abutments. The details of one of the piers on the sidewalk curb line are shown in Fig. 2. There are six 36 × 30-in. rectangular columns (with chamfered corners), carrying the girder upon which the floor slabs rest, the piers and girder forming one monolithic structure. Each column stands upon a 4-ft. cylindrical pier, extending to a firm foundation on hardpan at a depth of from 35 ft. to 40 ft. below the surface of the ground. The lower ends of these piers are belled out to a bottom diameter of 8 ft., the load on the foundation at the base of the column being limited to 3.7 tons per sq. ft.

The wall in the middle of the roadway is of similar design, but the columns are 36 × 36 ins., with a top girder whose section is 36 × 36 ins. at the center of the arches. The columns have eight vertical ¾-in. bars, with 29-in. rectangular hoops of ½-in. bars. These hoops are 12 ins. apart. The foundation piers are 4 ft. diameter, as at the sidewalks, but they are belled out for 3 ft. to a base diameter of 9 ft. instead of 8 ft.

The excavations for the piers were sunk through sand and clay containing a considerable amount of water, and an interesting feature of the work was the drainage of the ground before excavation was commenced. This was effected by driving well-points into the ground and connecting these by pipes with the suction main of a triplex pump. The ground being thus drained, the excavations were carried down to hardpan without difficulty. Through the sand (about 10 to 15 ft.), the excavation was lined with vertical wooden staves braced by interior rings of steel. Below this, no lining was used.

The details of the floor slabs are shown in Figs. 3-4. Those for the roadway spans are 25 ft. long, 6 ft. 3 ins. wide and 34 ins. deep. These weigh about 33 tons each. The slabs for the sidewalk spans are 9 ft. 11 ins. long, 6 ft. 3 ins. wide and 18 ins. deep. In both cases the reinforcement consists of longitudinal and transverse bars near the upper and lower faces, and also inclined shear bars near the ends. The larger slabs have also transverse hoops of rectangular form. To provide for handling, steel loops and eye-bolts are embedded in the concrete. The loops are used for the larger slabs, the upper end lying in a pocket formed in the slab, so that the loop bar does not extend above the top of the slab. For the smaller slabs, eye-bolts are used, as shown. Over the piers, the joints between the ends of the slabs are kept open by a single thickness or layer of felt paper. Two layers of felt paper form an open joint at the bearing of the faces of the slabs upon the piers. Upon the completed floor will be laid some form of waterproof covering, and over this will be the ballast.

The bridges were designed under the direction of Mr. A. S. Baldwin, M. Am. Soc. C. E., Chief Engineer of the Illinois Central R. R., and Mr. R. E. Gaut, M Am Soc. C. E., Engineer of Bridges and Buildings. To them we are indebted for plans and other information. The Leonard Construction Co., of Chicago, has the contract for the work.

In view of the novelty and importance of this design of bridge, the railway company decided to have tests made of the strength of the slabs. These tests were made under the direction of Prof. A. N. Talbot, M. Am. Soc. C. E., of the Engineering Experiment Station of the University of Illinois (Champaign). As the testing of reinforced-concrete beams of such size, and made for actual use, is a matter of more than ordinary interest to the engineering profession, it was arranged that full information in regard to the tests and their results should be made available. We give below the paper prepared by Prof. Talbot dealing with this matter:

TESTS OF LARGE REINFORCED-CONCRETE BEAMS.

The test here described will be of interest to engineers for two reasons. (1) Because the reinforced-concrete beams were chosen almost at random from a large number of beams made up for use in a railway structure, and thus may be considered to be representative of actual conditions of construction; (2) Because the tests give a comparison of the efficacy of two methods of placing the reinforcement to resist diagonal tension or so-called shear failures. The beams were perhaps the largest reinforced-concrete beams yet tested, and the testing apparatus used and the method of making the test involved some novel features.

The beams were tested in the yards of the Illinois Central R. R. at 27th St., Chicago, close to the point where they were made. They were in the form of slabs 25 ft. long, 6 ft. 3 ins. wide, and 34 ins. deep at the middle. They weighed about 33 tons each. The tests were undertaken through the co-operation of the Illinois Central R. R. and the Engineering Experiment Station of the University of Illinois, to determine the properties of large beams made under practical conditions. As this is one of the largest and most important pieces of construction of the kind yet made, it seemed desirable to make tests of the slabs before putting the structure into service.

The slabs were built by the Illinois Central R. R. force. The concrete was composed of 1 part Owl Portland cement, 2 parts sand, and 5 parts unscreened limestone. The concrete was machine mixed and was made wet, so that little or no tamping was required. Tests of the cement gave a tensile strength of 822 lbs.

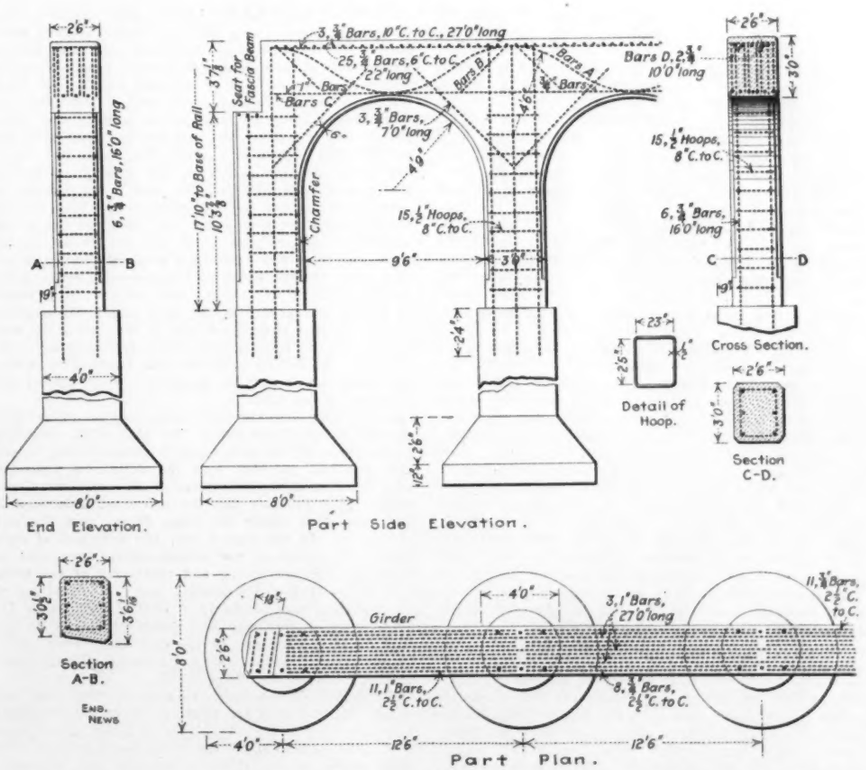


FIG. 2. PIER AND FOUNDATIONS FOR REINFORCED-CONCRETE SLAB FLOOR BRIDGES.

per sq. in. for the 7-day neat test; 95.2% passed the No. 100 sieve. The longitudinal reinforcement was of 1-in. corrugated bars. Tests made by Robert W. Hunt & Co. on bars selected from those used on the work showed an elastic limit of 52,000 lbs. per sq. in. There were 29 of the 1-in. bars used in the width of 6 ft. 3 ins., the spacing being made 2⅛ ins. c. to c.; and as the distance from top of slab to center of bars at the middle of the beam length was 30⅛ ins. the reinforcement was about 1.25%.

Two forms of bending up the bars at the ends were used. In No. 70, which was the last slab made in this way, the bars were bent up at an angle of about 45° rather close to the end. The bend for one-fourth of the bars started at about 2 ft. from the end, for another fourth at 3 ft., and for another fourth at 4 ft., while the remaining bars were straight throughout the length of the slab. No stirrups were used in No. 70. In the slabs made after No. 70 (including No. 71 and No. 72, which were tested), stirrups were used and the bars were bent up farther back from the end and less abruptly. This is seen in the figure showing the position of the beams in the test. In one-fourth of the bars the inclination started at a point 6 ft. from the end, in one-fourth 4 ft. from the end, and in one-fourth 2 ft. from the end. The remaining bars were horizontal. In these slabs, U-shaped stirrups made of ½-in. corrugated bars were placed vertically at distances of 2½ ft., 4 ft., 5½ ft. and 7 ft. from the ends of the slabs. Each stirrup passed under and included five reinforcing bars and reached nearly to the top of the slab.

In addition to the bottom reinforcing bars, four ⅛-in. cup bars were placed longitudinally 3 ins. from the top of the slab. Transversely across the slab, and 2 ins. below the top, were 12 ⅛-in. and six 1-in. bars, while transversely across the bottom longitudinal reinforcement were 21 ⅛-in. bars. At the middle of the width of the slab and at 2 ft. 6 ins. from either end, heavy steel stirrups were inserted. These were used to fasten the lifting device when the slabs were lifted and moved.

The slabs tested were made Oct. 7 and 8, 1907. No. 70 was tested on April 15, and No. 72 on April 28, 1908. In the meantime they were left where made and were exposed to the weather. Although they were over six months old, the setting of the concrete during the winter weather must have been slow, and the conditions would be less favorable than is usual for 90-day test beams.

The tests were made as follows: One slab was placed above another (the lower one having been turned upside down) with a bearing between them at their ends. Two yokes were placed at the one-third points of the span length, and four hydraulic jacks acting on the yokes were operated to force the slabs together. The diagram (Fig. 5) and the accompanying photographs will explain the method of making the test. The slabs were handled by means of a wrecking car of 100 tons capacity (shown in Fig. 6), and this machine did the work easily and satisfactorily. In inverting slab No. 71, however, the great weight on one rail caused one side of the temporary construction track to settle considerably. To avoid possible overturning of the derrick car, the hoisting cable was slackened suddenly and the slab was dropped. It fell 4 ft., striking on a pile of stone and against a rail. One corner of the slab was cracked, but so far as the tests show no other injury was done.

The lower slab was supported on 12 × 12-in. timbers placed transversely across the slab at about 4 ft. from the ends. At either end a 12 × 12-in. oak timber was placed across the slab. These timbers were 23 ft. 6 ins. c. to c., and this distance was considered the span length in the test. The other slab was then placed right side up on top of these bearing timbers. The timbers were bedded in plaster of paris above and below in order to overcome small irregularities in the surfaces of the slabs. At the one-third points of the span length, yellow-pine timbers, 7 × 14 ins., were placed on top of the upper slab, and also on the under side of the lower slab. These were bedded in the same manner. Two 24-in. steel girders were placed at each one-third point on top of the timbers of the upper slab, and similar steel girders at the corresponding points below. Wrought-iron rods (four at each of the four points) and thick cast-iron blocks were used to complete the connections.

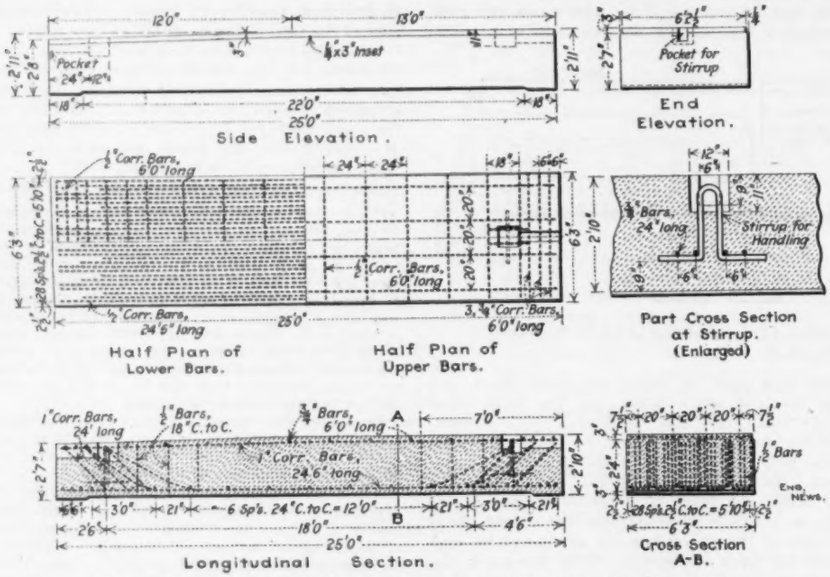


FIG. 3. REINFORCED-CONCRETE SLAB OR BEAM FOR ROADWAY SPAN.

The hydraulic jacks were placed between the upper girders and the upper cast-iron blocks. Each jack had an individual pump and gage. The jacks and gages had previously been calibrated; the loads given include the necessary corrections. The load was applied in varying increments, but the amount was kept equally divided among the four jacks. The timber pieces formed adjustable bearing plates over the unevenness of the slabs, and there was evidently a good distribution of the load over the full width of the slabs. It seems sufficiently accurate to consider the distance from center to center of supports as the span length. In general, it may be said that the action of the jacks, the uniformity of the results, and other circumstances, indicate that the testing apparatus was trustworthy within the limits which may be considered necessary for the purposes of the test.

In the first test the only measurements taken were the deflections of the slabs. The high wind prevailing at the time of the test made it impracticable to use the apparatus provided, and the deflections measured were the sum of the deflections of the upper and lower beams. It is probable that the individual deflections of the slabs were nearly the same except near the end of the test. In the second test, the deflection of each beam was measured, and extensometers were used to determine the lengthening and shortening of the beam and the position of the neutral axis. A second set of extensometers was placed in a vertical position to determine when there was a noticeable increase in vertical distance, as would be the case upon formation of horizontal or diagonal cracks across the line of measurement.

The results of the tests are given in the table and diagrams. The diagram (Fig. 7) gives the combined deflections of No. 70 and No. 71. In Table I are notes of the test of No. 70. It should be borne in mind that the condition of the surface of the slab was not favorable to the early discovery of cracks. Fig. 8 is a view showing the failure of No. 70 by diagonal tension.

The results of the test of No. 72 are given in Table II., and in the diagram (Fig. 9). The calculated stress in the steel is based on the formula for resisting moment, $0.87\,Afd$, where A is the area of the reinforcing bars, f is the stress, and d is the distance from top of slab to center of bars, called here 30⅛ ins. The surfaces of No. 71 and No. 72 were coated with whitewash and marked off in 6-in. squares, and the position of the cracks at the different loads was noted and traced in pencil as the test progressed. The cracks were afterward painted with black paint and hence appear greatly magnified in the views, Figs. 10-11. The numbers on the photographs mark the limit of the cracks at the applied load given for the same number in Table II. These numbers permit the growth of the cracks to be traced. The smooth white surface permitted the cracks to be seen while very small, and the tension cracks in No. 72 were noted at much lower loads than in No. 70, which had not been whitewashed. The measurements on the lower slab,, No. 71, in the second test were made with a type of instrument which is not entirely suitable for this form of test, and as the results are somewhat irregular they are not given here. The readings of the vertical extensometers showed a marked increase in the later stages of the test and will be referred to in the discussion of diagonal failure.

TABLE I.—TEST OF BEAM NO. 70.

25,000 lbs.	This load is assumed to be weight of ing apparatus, men and initial te on rods.
333,000 lbs.	First tension crack at center of top s
364,000 lbs.	Small tension crack at north load of slab.
432,000 lbs.	Second tension crack near center of slab.
468,000 lbs.	First diagonal crack outside north loa
496,000 lbs.	Numerous small tension cracks.
593,000 lbs.	First diagonal crack, lengthening ra and becoming more marked.
626,000 lbs.	Cracking along the steel at south end.
693,000 lbs.	In the interval after 488,000 lbs. diagonal cracks appeared near the
734,000 lbs.	First diagonal crack opening wide.
801,000 lbs.	Failed suddenly along first diagonal cr which reached top just inside the point.

As is usual in such tests, minute cracks become visible in the concrete on the tension side of the beam between the load points as the load was applied and on the outside of the load points at higher loads. These cracks grew in height and became more marked as the load was increased. In the first test (No. 70 and No. 71 together, Fig. 7), in which the beams did not fail by the reinforcing steel stretching up to the yield point, these cracks closed up upon the release of the load to such an extent as to be scarcely detectable. In No. 70 (not whitewashed) the first tension crack was noted at an applied load of 333,000 lbs., and numerous tension cracks at 496,000 lbs. In No. 72 (whitewashed surfaces), the first tension crack was noted at 159,000 lbs., and numerous tension cracks at 189,000 lbs. It will be seen from the photographs that some of these minute cracks reached points 12 ins. from the top of the slab before the reinforcement was stressed to its yield point. Even when they had thus grown, their size at the bottom was minute.

Outside the load points (that is, in the outer thirds of the beam length), diagonal cracks appeared, frequently forming from the top of a vertical crack already visible and extending diagonally upward and downward at the same time. In No. 70, the first diagonal crack was visible at an applied load of 468,000 lbs. and in No. 72 cracks became distinctly diagonal at 447,000 lbs. The diagonal cracks developed with the addition of load, but the form of this development was not the same in No. 70 and in No. 72. In No. 70 (the slab without stirrups and having the bars bent up abruptly near the ends), one main diagonal crack formed outside each load point making an angle of about 35° with the horizontal. While a few others became visible, these main cracks enlarged and the final failure of the slab was along one of them. In No. 72 (whitewashed surfaces), several marked diagonal cracks had extended for some distance at the load of 480,000 lbs. Some of these finally extended to within 12 ins. of the top face of the slab, but they remained small and fine and were well distributed over the beam.

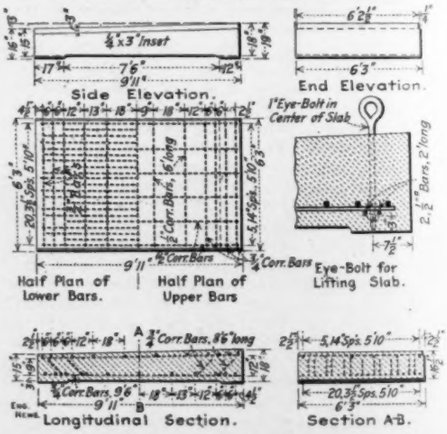


Fig. 4. Reinforced-Concrete Slab or Beam for Sidewalk Span.

The manner of failure of No. 70 and No. 72 was quite different. Although it is evident from calculations that the steel of the reinforcing bars in No. 70 had nearly reached the yield point, there was no evidence of this in the appearance and action of the beam at the time of failure. At a load of 593,000 lbs. the main diagonal crack outside of one load point was seen to be extending rapidly, and at 734,000 lbs. it was opening wide. It was evident for some time that the beam was on the verge of total failure. Finally it failed suddenly by diagonal tension (so-called shear failure) at an applied load of 801,000 lbs., the diagonal crack having suddenly extended to the top of the slab and opened wide. At the same time the horizontal crack which had formed along the reinforcing bar (by the action of vertical tension) lengthened, and the bar pulled away from the concrete above.

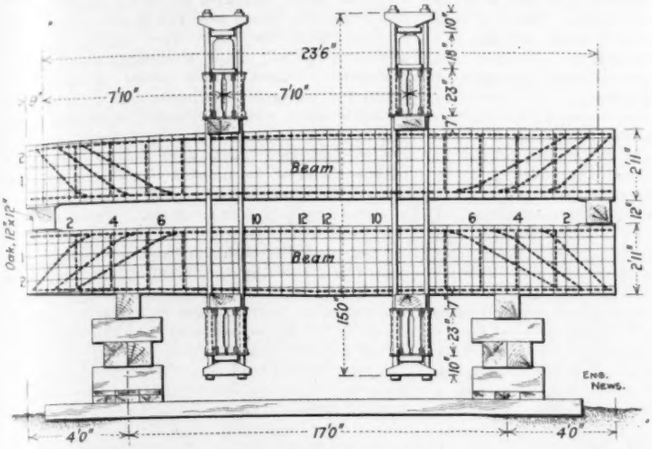


FIG. 5. ARRANGEMENT OF APPARATUS FOR TESTING REINFORCED-CONCRETE BEAMS.

The characteristic of the test was the formation of main diagonal cracks at either end and the final sudden failure of the beam by diagonal tension. In No. 72, the presence of the stirrups and the changed position of the reinforcing bars at the ends were sufficient to resist the diagonal tension developed. Although the diagonal cracks were numerous and although some of them finally extended to within 12 ins. of the top face of the slab, they remained small and fine and were well distributed. They lacked the growth and concentration which are apparent in failures by diagonal tension in beams without metallic web reinforcement.

The tension cracks in the middle third of the beam extended upward as the load was increased, and at 811,000 lbs. nine of these were visible to within 12 ins. of the top of the slab. At this load, the tension cracks were opening wide, indicating that the yield point of the reinforcing steel had been passed. The maximum load applied was 840,000 lbs., but above 800,000 lbs. the deflection increased rapidly. It seems evident that a load of 811,000 lbs. would not have held long, and the maximum load applied held but momentarily. After the maximum load was reached, the load fell off as the deflection was increased.

The characteristic of the test of No. 72 was slow failure by tension of the steel, without sign of compression failure and without sign of impending failure by diagonal tension. The effectiveness of the stirrups and the bending of the bars at the ends is made evident by the test. This is the more important as the diagonal tension failure may give little warning and may develop with repetitions of lower loads. It may be noted that on the next day the test was continued until there was a deflection in No. 72 of 3½ ins., and the load applied was nearly 800,000 lbs. Upon release of load there was a recovery of 1 in. in the deflection. At this time, the stretch of the steel and the consequent concentration of the compressive stress were so much that there was considerable crushing of the concrete. Slab No. 71, which was used as the lower beam in both tests, seems not to have suffered from the first test, the cracks closing up upon release of load. In the second test, the tension cracks opened up and at the maximum load there was evidence of the steel being stretched beyond the yield point. It should be noted that on account of its inverted position and the location of the supports the bending moment developed in the lower beam was somewhat smaller than that in the upper beam. There was no sign of impending failure by diagonal tension.

The proportionate depth of the neutral axis for the amount of reinforcement here used, based upon ordinary assumptions, would be in the neighborhood of 0.43 to 0.47. Calculations from the observed deformations give a position which seems abnormally high, averaging during the later stages of the test about 0.34 of the distance from the top of the slab to the center of the reinforcing bars. An examination of the original data suggests that there was slip in the top extensometers and that the neutral axis must have been lower than shown by these results. The vertical position of the line for top fiber compression given in the diagram between loads of 220,000 lbs. and 320,000 lbs. (showing little increase in the compression) shows where the trouble lies. It should be noted that with such slip of the upper extensometer the real compressive deformation would be greater than that given in the diagram and that the real tensile deformation would be somewhat less.

The vertical shearing stress in the concrete at the breaking load of No. 70, is 209 lbs. per sq. in. This is calculated by the formula $v = \frac{V}{bd'}$.

Here V is the total vertical shear at the point where the crack begins, including the shear due to weight of slab; b is the width of the slab, and d' is the distance from the center of the reinforcing bars to the center of gravity of the compression area of the concrete (called here 0.87 of the depth to center of reinforcing bars). The vertical shearing stress so calculated may be used as a means of comparison of the resistance to diagonal tension. This stress (200 lbs. per sq. in.) is a high value for a beam without stirrups and having bars bent up abruptly at the end, and shows a good quality of concrete.

The value of v for the applied load of 468,000 lbs., where the first diagonal crack was noted, is 125 lbs. per sq. in. For the applied load of 593,000 lbs., where the main diagonal crack was seen to be lengthening rapidly and becoming more marked, it was 156 lbs. per sq. in. In No. 72, the value of the vertical shearing stress, v, at the maximum load applied is 220 lbs. per sq. in. As there was no sign of impending failure and as the diagonal cracks closed up after the failure of the beam, it is seen that the provision against failure by diagonal tension was very satisfactory. At the load of 447,000 lbs. (giving a vertical shearing stress of 120 lbs. per sq. in.) there was a marked increase in the reading of the vertical extensometer at one end of the beam and an evident development of the diagonal crack. A similar development was noted with the extensometer at the other end at a load of 514,000 lbs. Above these loads the readings of the vertical extensometers increased rapidly.

The tension in the reinforcing bars at the middle of No. 70, calculated by the usual methods, and including the effect of the weight of the beam, was 51,700 lbs. per sq. in. at the maximum applied load of 801,000 lbs. As the tension cracks in the concrete closed up after the failure of the beam it would seem that the steel had not been stretched beyond its yield point. In No. 72, the calculated tension in the reinforcing bars, including the effect of the weight of the slab, was 54,000 lbs. per sq. in. for the maximum applied load of 840,000 lbs. For the applied load of 811,000 lbs., where the yield point evidently had been passed, the calculated tension is 52,300 lbs. per sq. in. These values check up with the yield point of the material within the limits of variation of such material.

The compression in the upper fiber calculated by the ordinary methods runs up to a high figure, as is usual in tests of beams having a considerable amount of reinforcement. Assuming the neutral axis to be at 0.43 of the depth to the reinforcing bars, and using the ordinary straight-line formula, the compressive stress in No. 72 at the maximum load was 3,190 lbs. per sq. in. Using the parabolic formula and considering that the compressive deformation is half of the ultimate compressive deformation of concrete, the calculated stress is 2,870 lbs. per sq. in. Even at this high calculated stress there was no sign of compression failure until after the steel had stretched beyond its yield point. Comparing the deformation developed with that of other tests, it seems probable that the beam would have taken at least one-third more compressive stress before failure in compression at first loading. Of course, repetitive loading at any such high load might soon have injured the beam.

The tests showed that the concrete was of excellent quality and that the slabs acted similarly to high-grade test beams made and tested in laboratories. The uni-

TABLE II.—RESULTS OF TEST OF REINFORCED-CONCRETE BEAM NO. 72.

Ref. No.	Applied Load. lbs.	Average Deflection ins.	Stress in steel[1] lbs. per sq. in. From Deformation.	Stress in steel[1] lbs. per sq. in. From bending Moment.
0	25,000[2]	0.00	.....	1,500
1	45,000	....	.....	2,700
2	67,000	0.01	300	4,100
3	103,000	0.02	1,200	6,300
4	131,000	0.03	2,100	8,000
5	159,000[3]	0.05	3,600	9,700
6	189,000[4]	0.10	6,000	11,500
7	220,000[5]	0.11	7,500	13,400
8	253,000	0.13	10,500	15,300
9	285,000	0.17	14,700	17,400
10	317,000[6]	0.18	17,700	19,300
11	350,000	0.24	20,100	21,400
12	382,000	0.28	23,100	23,300
13	414,000	0.31	25,800	25,300
14	447,000	0.36	27,900	27,300
15	480,000	0.40	29,400	29,300
16	514,000	0.43	31,800	31,400
17	578,000	0.52	36,900	35,300
18	643,000	0.61	42,000	39,300
19	704,000	0.70	47,700	42,900
20	780,000	0.88	61,200	47,700
21	811,000[7]	1.32	108,000	49,000
22	840,000[8]	1.60	.....	.....

[1]Add 2,800 lbs. per sq. in for stress due to weight of slab.
[2]This load of 25,000 lbs. is assumed as the weight of testing apparatus and men, and the initial tension of the rods. After the jacks were in operation, all but 9,000 lbs. was indicated by readings of the jacks. The "average extensometer readings" are for a gage distance of 50 ins.
[3]Short tension crack just inside south load point.
[4]Numerous tension cracks at 189,000 lbs.
[5]Vertical cracks just outside load points.
[6]More cracks outside of load points.
[7]Tension cracks opening wide at 811,000 lbs.
[8]Maximum load. Tension failure.

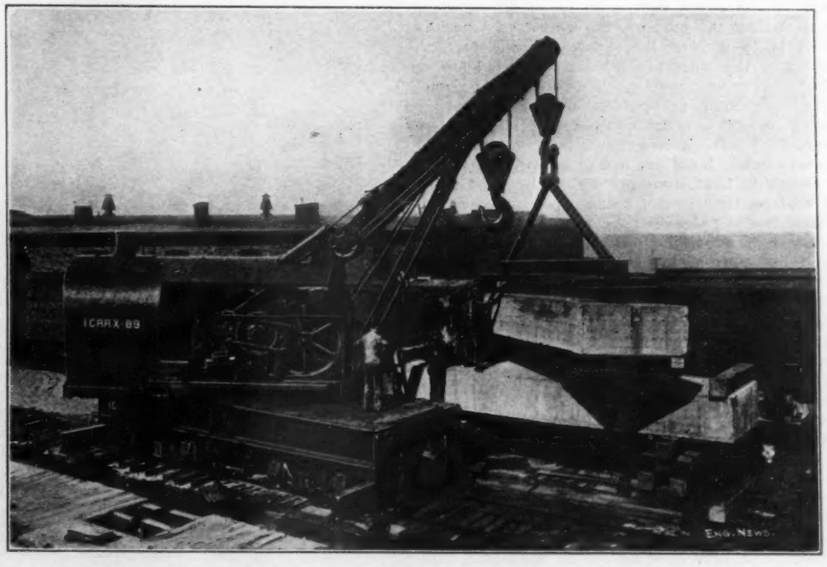


FIG. 6. HANDLING 33-TON CONCRETE BRIDGE BEAMS WITH A 100-TON WRECKING CRANE; ILLINOIS CENTRAL R. R.

formity and regularity of these large beams are shown in various ways in the tests. As these slabs may be presumed to be fairly representative of the slabs made for the bridges, the tests will add confidence in the quality and soundness of the reinforced-concrete used in this work. The action of the concrete in compression under the high stresses developed was quite satisfactory. The tests show the effectiveness of stirrups and of the method used in bending up bars at the end in resisting diagonal tension. As diagonal tension weakness is particularly undesirable, because of possibility of sudden failure and of injury with repeated application of the load and because of the difficulty of detecting incipient failure when the sides of the beam are not available for inspection, ample safety against these stresses is important. Failures by tension of the steel and by compression of the concrete give warnings through abnormal deflections and in other ways and are less likely to lead to serious results.

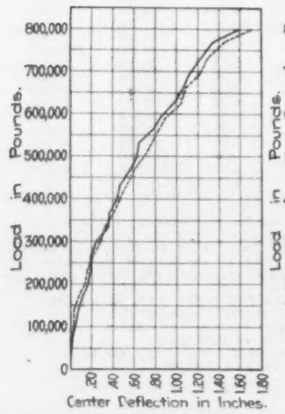


Fig. 7. Diagram of Deflections Bridge Beams of Concrete Nos. 70 and 71.

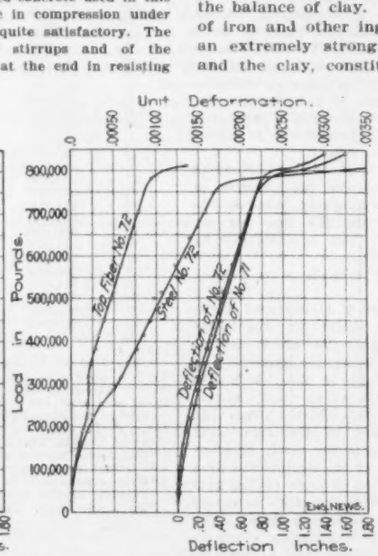


Fig. 9. Diagram of Deflections and Deformation of Concrete Beams Nos. 71 and 72.

TRAIN DESPATCHING BY TELEPHONE is gaining in favor with American railways. The Illinois Central is now operating 346 miles of its line by telephone, and has equipped 502 miles more for telephone operation. A committee of the American Railway Association recently inspected the system of train despatching by telephone in use on the Chicago, Burlington & Quincy R. R., and reported favorably upon its convenience and efficacy. The advantages and method of this system were mentioned in our issue of July 2.

RIVER GRAVEL FOR BALLASTING RAILWAY TRACK: ILLINOIS CENTRAL R. R.

Gravel is used more extensively than any other material for ballasting railway track in this country. While clean, coarse gravel is an excellent material for the purpose, the gravel as generally used is to a very large extent unsatisfactory, owing to the large proportions of sand, loam or clay of varying qualities. Broken stone is generally considered preferable for ballast, but in many cases it is difficult to obtain, while the cost (especially with a long haul) is prohibitive. In certain cases, however, it has been found a real economy to haul stone for several hundred miles to replace dirty gravel ballast in track carrying heavy traffic. Gravel that has been washed or screened is superior to that which is used just as it comes from the pit, and some methods of washing gravel were described in our issue of Aug. 1, 1907. An interesting practice on some Southern railways is the use of naturally-washed gravel obtained from river beds. Particulars of this ballast have been furnished us by Mr. H. R. Safford, Chief Engineer of Maintenance of Way of the Illinois Central R. R.

The southern lines of the Illinois Central R. R. and the lines of the Yazoo & Mississippi Valley R. R. traverse the western and central portions of Mississippi and the western portion of that part of Louisiana lying east of the Mississippi River. The geological formation of this portion of the Mississippi valley includes practically no limestone, a very poor supply of sandstone, and none of what is known as free gravel except that found in the bed of streams. There is in the highlands of the State of Mississippi a great deal of gravel material which contains probably 30% of good hard pebbles, about 30% of sand, and the balance of clay. In the clay there are oxide of iron and other ingredients that tend to make an extremely strong bond between the pebbles and the clay, constituting what is known as a cementing gravel. There is no gravel or hard material of any kind to be found east of the Yazoo delta, as the soil is entirely alluvial. In the eastern portions of Mississippi there are found some small deposits of limestone. These are extremely limited in area and depth, being merely a thin crust ranging from 12 to 36 ins. in thickness, and they do not exist at any point in sufficient quantities to justify establishing a plant for crushing.

The lack of good material for ballast has been a great drawback in the economical maintenance of track, and this has been an important question for all railways in the territory mentioned. The bank gravel previously described in found in large quantities. It can be dug readily with steam shovels, and can be handled about as cheaply as loose gravel, so far as distribution and labor of putting in the track is concerned. But it has a large percentage of clay, which dissolves and disintegrates under the action of heavy rains. This causes the track to settle very readily under heavy traffic, and with such material it is very frequently necessary to resurface the track after every heavy rain. As the material contains sand and clay, it readily absorbs moisture; and when very moist it resembles earth or dirt ballast. In addition, by reason of its great absorption, it causes premature decay of the ties. All of these conditions conduce to a heavy cost of track maintenance. The uncertain action of the cementing gravel formerly used is a serious objection to its use. Track surfaced when the ballast was dry could be made to ride as smoothly as any material. An extremely heavy downpour of rain, however, would, in a single night, render useless the work of months of surfacing. It was frequently found that a rapid dissolution of material during heavy rain would cause places to appear in the track that would prove dangerous without careful watching.

The Illinois Central R. R. and the Yazoo & Mississippi Valley R. R. have expended large sums in efforts to find suitable ballasting material of such character as to be unaffected by the elements. These searches were fruitless until it was found that there were large deposits of gravel in the bed of the Mississippi River and its tributary streams, which afford excellent material for ballasting purposes. This material is found in bars, and is composed of pebbles ranging from the size of a pea to a maximum of 2 ins. in diameter. These bars usually exist in the neighborhood of the mouths of the streams. The mass is well mixed with a very clean sand, and is almost entirely free from clay. These bars are the result of glacial and river action, the pebbles coming from the highlands and having been carried to the river by the tributary streams, being well washed in the movement. The action of the water in carrying this material has entirely removed the soil or earth, so that the gravel beds are free from such material.

It has been found practicable to dredge this material from the bottom of the river by hydraulic action. It is lifted onto barges, and passed over properly arranged screens to entirely wash out any particles of loam that may be in it. In the same process, the percentage of sand is reduced or increased so as to produce what is known as free gravel. The material is lifted from 20 to 25 ft., depending upon the stage of the river. When washed and treated to secure the proper proportion of sand and pebbles, it is said to make the best material known for economical maintenance of track. It is not affected or washed away by rain storms, and does not absorb or hold moisture like the cementing gravel. It can be handled cheaply by means of self-dumping cars, and when once placed in position and carefully tamped under the ties, it ensures stability for a great length of time. Track ballasted with such material will, if properly tamped, stay in position for from 6 to 18 months, depending upon the character of roadbed and amount of traffic. During this time no labor is necessary to keep the track in smooth condition.

Mr. Safford states that while it might be assumed that ballast of this kind should be entirely free from sand, this is not found to be the case.

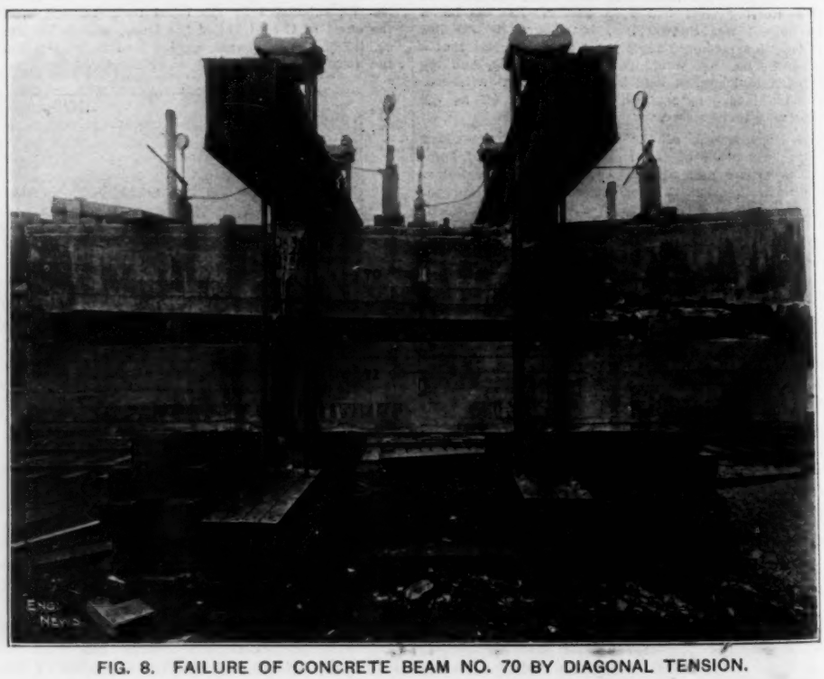


FIG. 8. FAILURE OF CONCRETE BEAM NO. 70 BY DIAGONAL TENSION.

The reason is that pebbles without sand would roll upon each other (on account of their smoothness and lack of cohesion) in such a way as to cause the ties to shift their position. Sand is required, therefore, in order to fill the voids and offer resistance to prevent the mass from moving. The proportion ordinarily used is 35% sand and 65% pebbles. It has been found from experience that a piece of track ballasted with such material requires no labor upon it for six or eight months, whereas with the previous forms of ballast used it necessitated resurfacing about four times per year, depending upon the weather.

This material is obtained by means of a plant at Memphis, Tenn., capable of producing from 1,200 to 1,500 cu. yds. per day. It is now being applied to the ballasting of the Yazoo & Mississippi Valley R. R. between Memphis and Vicksburg. There has been removed from the river for this purpose during the past 18 months, approximately 200,000 cu. yds. of material, and about 60 miles of track have already been ballasted.

In this connection we quote the following from Tratman's "Railway Track and Track Work":

Gravel Ballast.—This material is more used than any other, and is of very varying quality. It may be coarse and clean, or sandy and dusty, or loamy and cementing (when weeds will grow, drainage will be affected and the track will heave); or it may be full of large stones, in which case it will make an irregular and rough riding track. Cementing gravel (containing clay) should be avoided as far as possible. The best gravel is clean and coarse, with stones of small and fairly uniform size, and as little sand as possible. Only very clean gravel will drain as well as stone. It is good economy to use plenty of gravel, giving at least 10 ins. (or better 12 ins.) under the ties, as this will enable a fairly good track to be maintained nearly all the year through without excessive work. It can be tamped by picks or bars, the latter being usually preferred, and is easily taken care of. Sandy gravel may cause undue wear of tires, journals, etc., as well as discomfort to passengers. As a general thing, the gravel excavated at the pit is put directly into the track, although it usually contains a considerable portion of undesirable material. A few railways have experimented with screened and washed gravel with good results, and the development in better construction and maintenance is likely to increase the use of such material. In Europe, gravel is very frequently screened and washed by machinery to free it from clay, earth and sand, and this practice is coming into use in this country.

THE PRESERVATION OF IRON SUBMERGED IN WATER.

The recovery of old and long-buried specimens of iron and wood has been noted at different times in our columns. An interesting case of the preservation of iron continuously submerged in water has come to light during the construction of the new Mississippi River bridge of the Chicago & Northwestern Ry. at Clinton, Iowa. In removing part of the cribbing of the center pier of the old draw-span, some pieces of heavy strap or bar iron were recovered, which had been used in the construction of the pier in 1863. The straps were 2½ × ⅝ ins., and had only a single coat of red-lead paint. The paint is still mainly intact, and there are no indications of corrosion of the metal beyond the slight surface rusting. Pieces of the straps were shown to a member of our editorial staff during a recent visit by Mr. F. H. Bainbridge, Resident Engineer of the new bridge, who has furnished us with information concerning them.

The river is believed to contain probably more sand and loam in suspension than any other large river in the country, except perhaps the Ohio and Missouri rivers. The water is considerably harder than that of many other rivers, but this is not a matter of importance in this connection, as the neutral alkaline salts are not a material factor in the corrosion of iron and steel. What would happen to iron or steel submerged in water containing acids, such as that of the upper Ohio River, is an interesting question.*

The straps recovered at Clinton are of historical interest in that they were made from the old wrought-iron strap rails of the Galena Union Ry., which was built from Chicago to Freeport, Ill., in 1848-50. This line was the first section of what is now the Chicago & Northwestern Ry. The track from Chicago to Elgin consisted of 6-in. ties, 9 ft. long, spaced 30 ins. c. to c. and carrying two longitudinal timbers 6 × 6 ins. or 7 × 7 ins. On each longitudinal was an oak strip 1¼ × 3 ins., upon which was laid the iron strap rail 2½ × ¾ ins. The rails were probably worn down by traffic to the ⅝-in. thickness of the straps now recovered. The strap rails were replaced by tee rails in 1852.

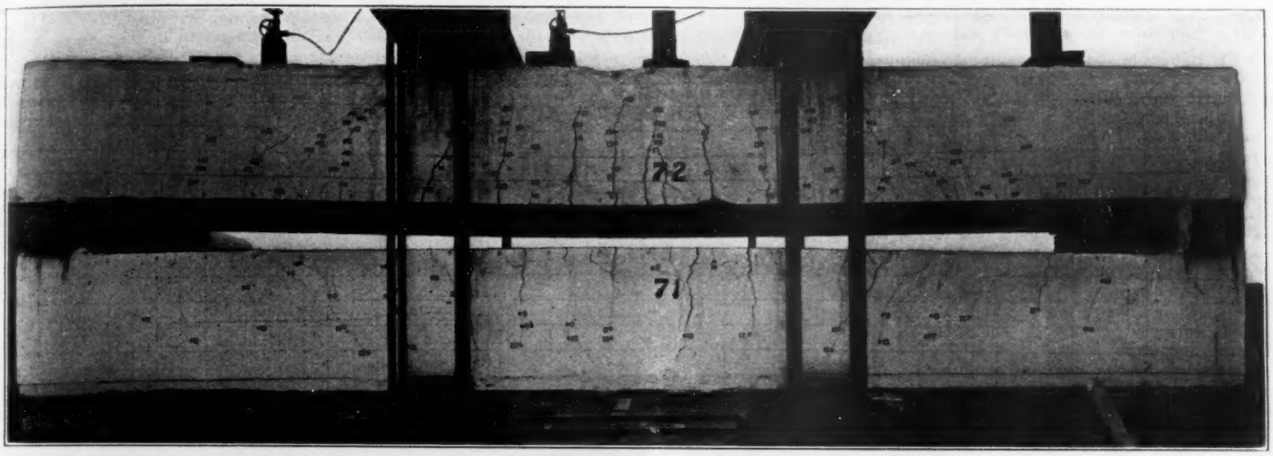


FIG. 10. TENSION CRACKS IN 25-FT. CONCRETE BEAMS NOS. 71 AND 72 AT MAXIMUM LOAD.

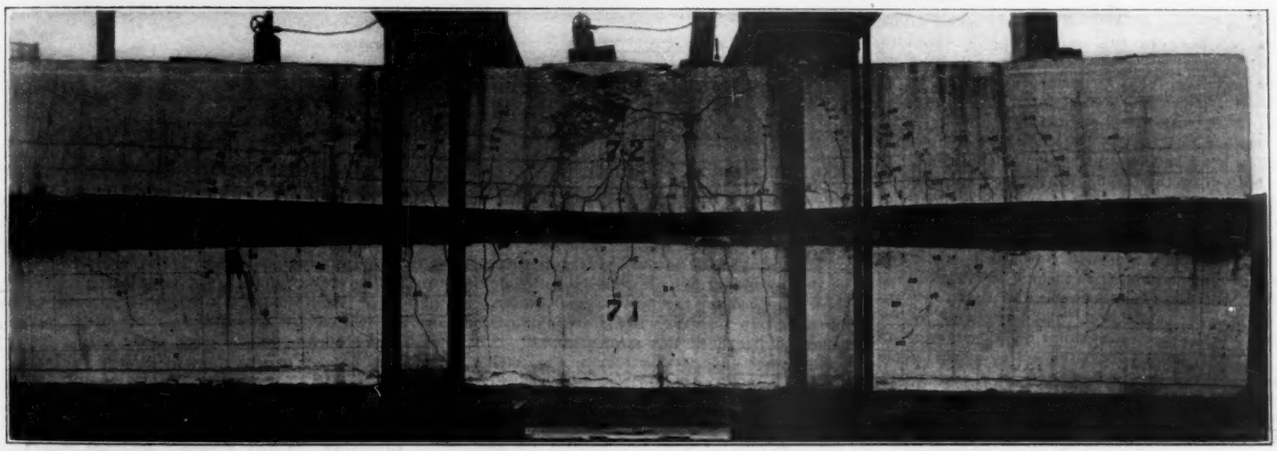


FIG. 11. FAILURE OF BEAM NO. 72.

*The following remarks concerning steel dams and lock gates in the Ohio are from a paper on "The Ohio River" read before the Engineers' Society of Western Pennsylvania by Mr. J. W. Arras, and from a report on "Lock and Dam No. 4, Ohio River," by Lieut. E. N. Johnston, Engineer Corps, U. S. A.

ARRAS.—The only apparent evidence of superiority of wooden gates over steel gates is that of durability. Like all metal lock gates, bear-traps cannot economically be painted or otherwise protected from corrosion, and must be given over to the merciless action of our acid-laden waters.

JOHNSTON.—Arrangements to coffer off and unwater each bear-trap are needed, as it will probably be necessary to paint the gates frequently because of the corrosive action of the acid in the water just below Pittsburg; and other repairs may be necessary.

SEWER CONSTRUCTION IN RUNNING SAND AT GARY, IND.: USE OF DRIVEN WELLS FOR LOWERING GROUNDWATER LEVEL IN ADVANCE OF TRENCHING.

In constructing a main sewer for the new city of Gary, Ind., very successful use is being made of the plan of pumping out the groundwater ahead of the trench excavation by gangs of driven wells alongside the line. The location is in low-lying, often marshy ground, composed largely of sand, much of which may be called quicksand—a very difficult material for deep trenching. The sand is so fine that when it is perfectly dry a person walking on it sinks in to the ankles. The bottom of the sewer trench is about 30 ft. below the natural ground surface, while the groundwater level is but 6 or 7 ft. below the surface. That the task of constructing the sewer promised to be a very delicate undertaking will be readily understood. The pumping method, however, eliminated the special difficulties of the problem almost entirely.

The pumping is done through longitudinal rows of 2-in. and 1¼-in. driven well-points extending one along either side of the work, and connected to longitudinal headers which enable a small number of pumps to drain all the wells. There is a separate group of wells for each of the two levels of the trench. The wells are spaced rather closely in the rows, averaging perhaps 2 ft. apart. The close cordon of wells thus formed extends from a point 100 to 125 ft. ahead of the trench back to the point where the full depth of trench is attained. The brickwork of the sewer is kept as close as possible to the latter point, of course, and backfilling follows the brickwork as closely as consistent with proper setting of the mortar. The principal protecting effect is thus concentrated in the region where digging is in progress. The sand is dried out so much that the soil will stand on a slope of 2 on 1, whereas in its natural condition it would assume a slope as flat as 1 on 15. The sheet-piling which is driven to hold the sides of the trench has thus a very greatly reduced service to perform.

The arrangement of the work may be explained with reference to the sketch Fig. 1 herewith, showing plan and profile of the trench. At the head is a Page scraper bucket excavator, which excavates down to groundwater level (about 8 ft.). It deposits the earth partly along the sides of the cut but partly also in advance, to form itself a level bed on which to move forward. In the bottom of this first level is the first group of wells, about 130 2-in. points sunk to a depth of 15 or 16 ft. below water-level. The two rows of these wells are rather close together laterally, so as not to interfere with the work of driving the sheeting outside of them. A longitudinal 4-in. header midway between the two rows receives a hose connection from each well, and a single No. 3 Emerson vacuum pump, mounted on an A-frame, pumps from the entire group. This pump, with 5-in. suction and 4-in. discharge, has a rated capacity of 725 gals. per min.

The A-frame is set on rollers on 3 × 12-in. plank, so that it can be moved forward quickly. The header pipe is made up in sections 22 ft. long joined by flanges and separated by gate-valves. The pump is first connected to the forward section of the group, but as the trench advances the rear section is cut off, disconnected, and connected up again at the front of the group, etc., so that finally the pump is on the last section and requires to be shifted. This is done as rapidly as possible, to keep the water down steadily. The valves in the header, however, permit the transfer of header sections to go on without cessation of pumping, only one section being shut down at a time. At the front of the header a 4-in. suction pipe with strainer is attached, to draw surface water from a small sump pit; this, of course, is shifted to the head whenever a section is transferred.

Each 22-ft. section of header has 11 valved double branches, with bushings for hose couplings (see Fig. 2). To these the wells are connected by 4-ft. lengths of 4-in. wire-lined rubber hose. The valves permit shutting off any well or wells of the group.

The first group of wells extends longitudinally about 130 ft. Near its rearward end the trench-sheeting is begun. This is of 2 × 8-in. plank, 12 ft. long, driven by mauls. Between the lines of sheeting the trench is excavated about 6 ft. deeper, by hand shoveling, and in this lower level is driven the second group of wells, to drain the subsoil down to the full depth of the sewer.

These wells are 1¼ ins. in diameter, and are jetted to a depth of about 16 ft., which is 4 to 6 ft. below the sheeting and about level with the bottom of the finished sewer trench. They are driven within the sheeting, but as close to it as possible, as the shovelers must work between the rows of wells. A 2-in. header along the top of each row connects the wells with the pumps. There are two pumps on this group, working in parallel, each being sufficient, however, to serve the entire group in emergency. They are hung from tripods set over the sheeting, and as it was not practicable to arrange these tripods on rollers, as in the first section, they require a longer time for shifting; the provision of two pumps has the result that pumping on the group need never be interrupted as the work advances.

The arrangement of the headers and connectors in the second group of wells is quite similar to that described for the first group. The extension of the group forward as the trenching proceeds is accomplished in the same way.

The work of jetting down the well-points proved simple and rapid. A 1-in. jet pipe with water at 100 lbs. per sq. in. carried the points down very quickly, and in a particular instance, where the time required was observed, two men sunk four 1¼-in. wells their full depth of 16 ft. in one minute.

The pumps discharge into a 10-in. tile drain-pipe laid in a trench alongside the main excavation, leading to the completed sewer, which is closed near its upper (uncompleted) end by a dam of sandbags. The seepage through this dam, and water draining in from other sources, are removed from the sewer by a fourth Emerson pump, of 250 gals. per min.; this pump is hung through a temporary manhole built in the top of the sewer.

The brickwork of the sewer is laid in a mortar composed of equal parts of Universal Portland and Utica natural cement. The invert is finished first, and the arch is built in a second stage. The lowest set of sheeting braces is taken out after the invert is completed, as the braces interfere with the construction of the arch.

The well and pumping equipment, as described, has given complete satisfaction. The sand, drained from excess water by the wells, was left in a damp, coherent condition in which it was handled easily and expeditiously. The pumps have given no trouble from sand or air, although considerable amounts of both these troublesome elements enter the system. They are of the peculiar steam displacement type, as described in our issue of Oct. 31, 1901, p. 334, and were built by the Emerson Steam Pump Co., Alexandria, Va. Their performance—no interruptions are reported—is especially important, as any shut-down of the pumps, even for an hour, would allow the water to return into the sand and saturate it, creating great danger of serious damage to the work by flow of the material and by the greatly increased pressure on the sheeting.

The contractor's plant employed in the construction of the sewer comprises, besides the four Emerson pumps, piping and about 300 well-points, as mentioned, the following items: Two-yard Page & Shnable drag bucket excavator, with 40-HP. engine; one-yard Hayward clam-shell excavator for backfilling; three 35-HP. horizontal boilers for the well-pumps, and a pile-driver boiler used for supplying the backwater drainage pump; a small duplex force-pump for jetting down the well-points, and boiler; and 2,800 ft. of industrial railway with 12 dump cars, which is laid along the side of the route for transporting material and supplies.

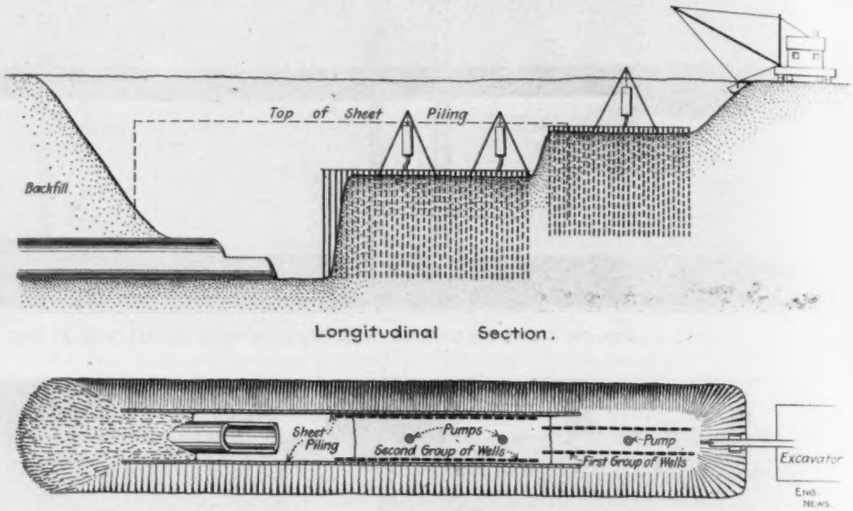


FIG. 1. PLAN AND PROFILE SKETCH OF GARY SEWER CONSTRUCTION, SHOWING ARRANGEMENT OF WELLS AND PUMPS FOR LOWERING THE GROUND WATER.

This description, based on notes made by Mr. C. M. Ripley during a visit to the work, is supplemented by some figures of labor cost collected by him at the same time.

SOME LABOR COSTS.

COST OF PUMPING, ETC.—The total fuel used on the work amounts to about $25 per day. Of this it is estimated one-half goes to supplying the four Emerson drainage pumps and the force-pump used for jetting down the wells; the pumping goes on night and day. The labor employed is seen from the table:

Fuel (24 hrs.)	$12.50
12 pipe line men, at $2.25	27.00
8 firemen, at $3.00	24.00
2 superintendents, at $3.00	6.00
	$69.50

Of this, $61 may be charged to the well pumping, while the remainder is the cost of pumping backwater.

COST OF SHEETING AND BRACING.—Twelve men employed during the 9-hr. working day in driving sheeting, setting braces, and pulling sheeting, make this part of the work cost as follows:

3 men driving sheeting, at $2.50	$7.50
4 men setting braces, at $2.25	9.00
4 men pulling sheeting, at $2.50	10.00
1 carpenter	3.00
	$29.50

This corresponds to a daily advance of about 60 ft., making the labor cost about 50 cts. per lin. ft.

COST OF TRENCH EXCAVATION.—The drag bucket excavator and the clamshell backfilling shovel consume half the total fuel, or $12.50 per day. Dividing this between them, we have a labor and fuel cost for the excavator of $20.25 per day (1 engineer, 1 fireman, 3 laborers, $14). A similar force employed on the backfilling gives the same cost. In the trench there are 140 shovelers, at $2.15, totaling $301. The total cost of excavating and backfilling, including pumping, sheeting, etc., is as follows:

LABOR AND FUEL COST OF EXCAVATION.

Bucket excavator	$20.25
Pumping and shifting pipes	69.50
Sheeting and bracing	29.50
Shovelers	301.00
Backfill	20.25
Waterboys	3.00
	$443.50

The backfill cost properly includes part of the shovelers' time, as some of the fill around the brickwork is done by them as soon as the arch is keyed up.

The excavator, on the other hand, was not worked to its full capacity in the normal progress of the work. In one emergency case it dug 850 cu. yds. in a single working day, which would give a labor and fuel cost of about 2½ cts. per cu. yd. on the basis of the figure above. For 600 cu. yds. per day normally excavated, this would reduce the expense chargeable to the excavator from $20.25 to about $15. In considering the very low unit-cost of this excavation, however, it must be remembered that a good share of its excavation is a charge on the machine itself, as some of the excavated material was dumped ahead of the machine to make a bed for it, and this amount necessarily appears twice in the total of excavation.

The total running cost of the work per day is:

Brick and cement	$277.50
Labor in brickwork	239.75
Excavating, pumping, sheeting, etc.	443.50
Clearing timber	4.00
Superintendence	50.00
	$1,014.75

To this must be added the cost of repairs, interest on plant, depreciation, etc., and cost of tools and miscellaneous supplies. Taking an average of 60 lin. ft. of sewer completed per day, the cost per foot from the above table is $16.91, plus allowance for the fixed charges and accessory expenses mentioned.

This sewer is part of a complete system, comprising about 20 miles of sewer, now under construction at a cost of some $350,000. Mr. A. P. Melton is City Engineer of Gary. About half of the work is being done by Green & Sons Co., of Chicago, Ill., and this concern is building the outfall sewer above described. Mr. J. W. Alvord, of Chicago, is Consulting Engineer for the sewer system, and Mr. W. F. Sargent is his representative on the work. Mr. E. M. Scheflow is Engineer of Construction for the contractors.

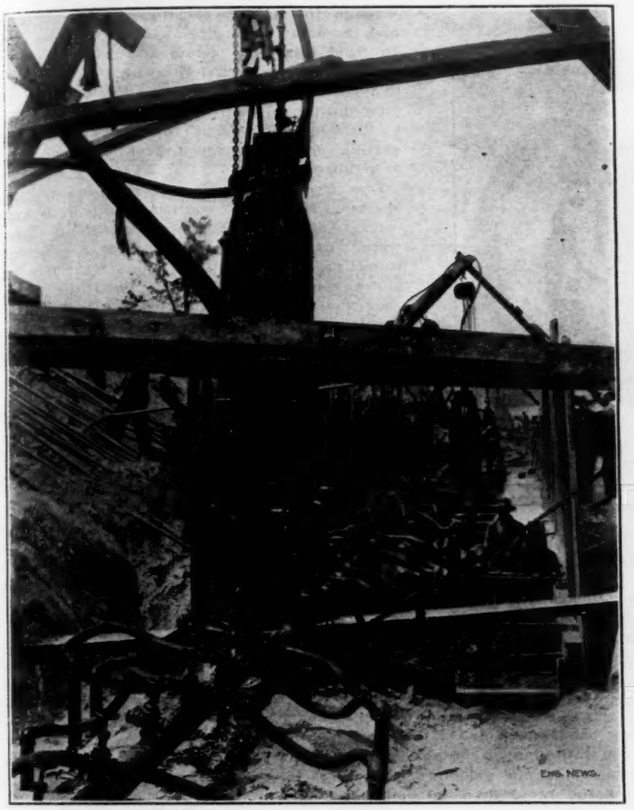


FIG. 2. VIEW AT HEAD OF SHEET PILING, SHOWING ADVANCE GROUP OF WELLS, HEADER AND VACUUM PUMP.

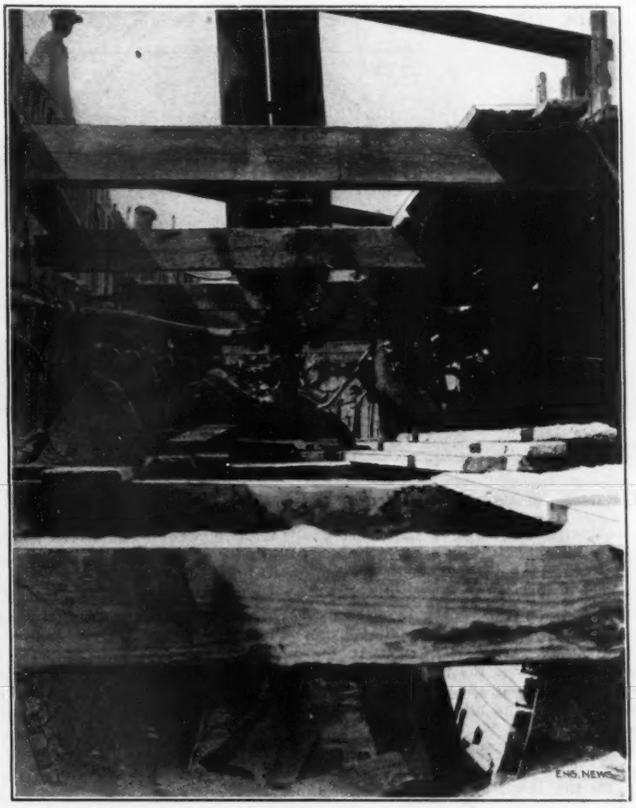


FIG. 3. PUMP DRAWING FROM THIRD GROUP OF WELLS AND FROM TRENCH BOTTOM AT HEAD OF SEWER BRICKWORK.

THE METHODS OF HANDLING A GERMAN LOCOMOTIVE.

A short paper on "The Fastest Train in Prussia," by Dr. W. F. M. Goss, Dean of the College of Engineering at the University of Illinois, is published in "The Technograph" (issued by the University). This gives an interesting description of the methods of operating the locomotive, as compared with American practice.

The train in question runs from Berlin to Halle, 102 miles, in 110 minutes, making no intermediate stop. The train when seen by Dr. Goss had cars aggregating 40 axles carrying approximately 8 tons each, or 320 tons in all. The locomotive was a single-expansion engine of the 4:4:0 class, with large driving wheels, piston valves, Walschaerts valve gear and the Schmidt superheater. The handling of the engine is described by Dr. Goss as follows:

The signal is given. With both hands the engineman pulls down on his throttle lever, which moves in a vertical plane, until it is more than half way open. Now that the engine is starting, he gives the throttle no further attention, but stands with his hands on the reverse-wheel, watching the struggle of the locomotive for mastery over its train. When the drivers slip, he catches them with a quick turn of the reverse-wheel before they have made a single revolution. If they hold well, he slowly turns reverse-wheel to lengthen cut-off.

Under similar conditions the engineman of an American locomotive would have had his hand upon the throttle lever, opening and closing it as the adhesion of the wheel might require. If it were suggested to him that the throttle be left well open, and that the output of power be controlled by means of the reverse lever, he would probably smile and tell you that the reverse lever is too clumsy a device to serve in giving the delicate gradations of power needed. But here stands the German at a screw-driven reverse gear (which has always been regarded by Americans as too slow and laborious for successful use) feeling with a sensitiveness of touch which is fine, the adhesion of drivers upon the rail, and with one hand and little effort holding his engine to the hardest work it is capable of doing.

High up upon the side of the cab is a speed indicator, which shows the engineman at a glance the rate at which he is running. In front of him besides the usual boiler gage, is another gage which gives the pressure of steam in the valve-box. The maximum boiler pressure is 180 lbs., and it is explained that the purpose of the engineman is to keep the valve-box pressure approximately 150 lbs. As the speed increases, he adjusts, by small increments, first the cut-off and then the throttle until the output of power and the conditions of pressure are to his liking. Another dial before him is that of a thermometer indicating the temperature of the steam in the valve-box. This at the instant of starting was but little above 400° F., but has since risen steadily. It is desirable that it should not go above 660° F. By the time we are at speed it has passed the 550° mark, and the engineman crossing over to the fireman's side turns a wheel attached to a light shaft running forward over the boiler. This partially closes the damper and thereby diminishes the flow of furnace gases through the superheater.

At the crossing of the Elbe, 63 miles from Berlin, for the first time during the run the throttle was closed and the brakes applied for a slow at the bridge. The engineer of an American locomotive, after closing the throttle, must move the reverse lever to its extreme position on the quadrant in order that the compression effects in the cylinders may be reduced. But our engineman does nothing of the sort. He allows his reverse gear to stand in running position, but pulls a handle which opens a valve in a by-pass connecting the two ends of the cylinder. This open by-pass affords relief from the compression that would otherwise occur.

Toward the close of our journey we were running ahead of our schedule and were several times required to slow on signal, notwithstanding which fact we were at Halle two minutes before we were due.

A NEW DESIGN OF MOVING-COIL VOLTMETERS.

Several instrument makers in past years have endeavored to put out a line of electrical instruments of good grade and fair accuracy at a low price to satisfy the demand which the higher-priced instruments could not fill. Heretofore the cheaper direct-current instruments have been of that general type of construction in which a mass of iron is moved by the magnetic effect of a coil. The accuracy of most of these instruments has not been all that was desired; they do not show a reversal of voltage; they are rather too much affected by temperature and external magnetism; and they waste more energy in operating than does the moving-coil type.

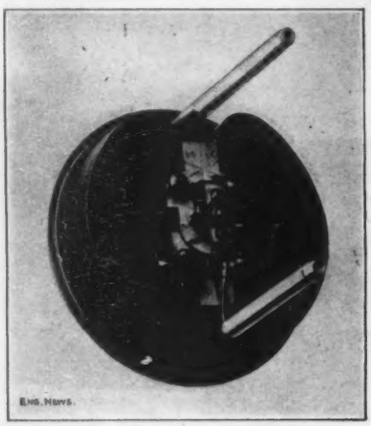


Fig. 1. View of Assembled Mechanism of Westinghouse Single-Gap, Moving-Coil Voltmeter.

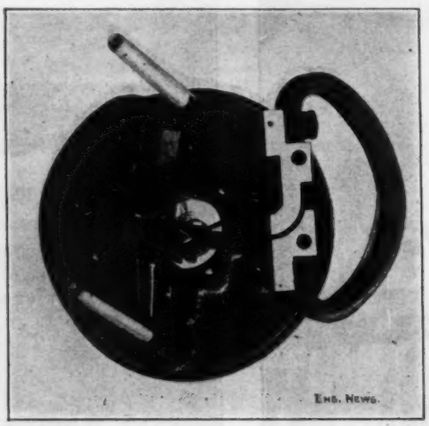


Fig. 2. New Westinghouse Voltmeter, With One Magnet Removed.

The Westinghouse Electric & Manufacturing Co. has developed a line of direct-current voltmeters and ammeters (milli-voltmeters with a heavy shunt) of the permanent-magnet, D'Arsonval type. It is claimed that the price of these is as low as the best of the "moving-iron" instruments and that they possess nearly all the advantages of the high-class moving-coil instruments.

The general mechanism is shown in Figs. 1 and 2. The most interesting feature of the design is the single-air gap by which the instruments depart from the common D'Arsonval design of a bipolar permanent magnet and two air gaps in series. The peculiar shape of pole piece to enable the use of a single air-gap is shown in Fig. 2. The permanent magnets may be removed without disturbing the moving parts. The moving coil balances the weight of the pointer. The mechanism is mounted in a black electrose case, 5 ins. in diameter. Brass studs projecting from the rear of the works, and serving as terminals, support the instrument on the switchboard.

The low cost is largely due to the lightness of the instrument, and to the fact that there are no hand operations in its manufacture aside from the assembly. The parts are all machine made in large quantities, with accurate tool equipment, the assembler merely attaching these parts together without the necessity of further fitting.

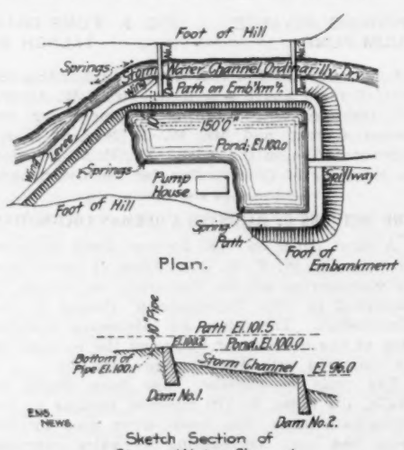
IN THE KEYSER VALLEY PLANT, recently completed by the Delaware, Lackawanna & Western R. R., to supply power and light to the collieries of their anthracite mines near Scranton, Pa., the ashes are made use of in a rather unusual way. They fall from the fireboxes into a tunnel which slopes at a grade of ⅝-in. per foot. Water pumped from one of the nearby mines is brought into this tunnel and flushes the ashes into a borehole leading to another part of the mine. The ashes are carried by the flow of water to the abandoned workings, where they pile into a mass and become solid when the water drains off. It is stated by Parker & Bridge, 20 Broad St., New York, that the ashes in this way form pillars which support the rock and earth above and permit the removal of that coal which had to be left unmined to prevent surface cave-ins. It is estimated that about 50 tons of ashes are flushed into the mines from under the boilers every day.

CONTROL OF FLOOD WATER AT A SMALL RESERVOIR.

By ALEX. R. HOLLIDAY,* Assoc. M. Am. Soc. C. E.

It occasionally happens in landscape architectural development that miniature engineering problems arise that can be solved by methods used in the general practice on a large scale. A problem of this character came up a few years ago in the development of a country estate.

The source of water supply for this estate had been a small spring-fed pond lying in a valley between steep hills. These springs had a uniform flow of 6 cu. ft. per min. During storms, however, the surface flow was fifty times this amount, due to the steep hills, and all of this went through the pond. The surface water carried debris and a large quantity of gravel sediment from a wash up the valley. Each year the small pond had to be dredged out. In the development of the estate a larger pond was desired for landscape purposes, and also some method for caring for the debris and sediment carried by storm water. Accordingly, the old pond and adjacent part of the valley were excavated, and the material was deposited in embankments to form the new pond and a diverting levee to throw all storm water into a channel excavated for this purpose, on one side of the valley. On account of the rapid drop in the valley, dams were necessary in the storm channel to maintain its level and prevent erosion on the embankment between it and the pond. The embankment and storm channel were placed, presumably, so that all springs would be inside the protected area and flow directly into the pond. The accompanying sketches show the embankment and storm channel as designed and built.



Sketches of Method Employed to Divert Storm Water from a Small Reservoir.

As the storm channel was being excavated it developed that the sources of over half the spring water were being tapped by the new excavation. In order to get all spring water to the pond, the plans were modified by placing a 10-in. pipe through the embankment above Dam No. 1 and protecting the mouth of the pipe by a concrete wing. The mouth of the pipe was placed 0.1-ft. below the top of the dam and a 3-in. horizontal space left between the end of the wing and the dam. As the dam was 0.2 ft. above the pond water level this allowed all spring water originating above the dam to flow through the narrow opening between the wing and the dam to the pipe and thence to the pond. In flood times the debris and sediment is diverted from the narrow opening by the wing and goes over the dam. The flow through the pipe during floods is of course increased, but so little material reaches the pipe that the iron grating originally placed over its mouth has been abandoned.

This arrangement has now been in successful operation three years and has been entirely automatic. Somewhat similar problems in storm water disposal arise in connection with city water supply, as in the Altoona reservoirs and storm channel so noticeable from the Horseshoe Bend of the Pennsylvania R. R. It is hardly possible, however, to reproduce the automatic control feature of this small water supply on works of magnitude.

*The National Concrete Co., Indianapolis, Ind.

A PETITION TO REMOVE THE HIGH TENSION LINES OF THE NEW YORK CENTRAL & HUDSON RIVER R. R. IN NEW YORK CITY.

Copies have just been issued of the brief of the counsel for the Commissioner of Water Supply, Gas and Electricity in the matter of the petition to the Public Service Commission for an order directing the New York Central & Hudson River R. R. to place underground all its transmission and distribution conductors within the limits of the City of New York. The Commissioner claims that the New York Central has erected an aerial transmission line along its right-of-way and over the streets of the city without a permit and contrary to law. The Commissioner has brought the petition to the Public Service Commission, as he claims no jurisdiction over the right-of-way of the railroad where it does not cross streets. The Commissioner of Water Supply, Gas and Electricity, the brief shows, does not desire to order a conduit system at street crossings if the commission proposes to allow overhead lines between streets along the right-of-way. Therefore the Public Service Commission is petitioned to order all conductors underground. This order would not affect the third-rail installation, in itself, but merely the overhead lines now carried on steel poles.

The brief reviews the history of the case and cites "the laws and public policy" in relation to placing electrical wires underground in the City of New York. The voluminous evidence in regard to the public safety and cost of aerial or conduit lines and in regard to the legality of the New York Central's action is summarized very briefly.

One interesting part of the brief is the inclusion of a report on a recent accident on the New York, New Haven & Hartford R. R., at Greenwich, Conn. This accident was briefly described in Engineering News, July 23. The train, as noted, was derailed on a 3° curve, and while the train with several overturned cars traveled along the track and seemed to be guided by the rails, yet the trucks flew off at a tangent and would have knocked out the supports for the 11,000-volt catenary construction, letting it down on the tracks, had not a considerable part of the curve been along a rock cut into the face of which deep niches had been cut to receive the catenary-system supports. One steel pole not in such a protected situation had its concrete base cracked, although this pole was at the far end of the disturbed area and where the force of the truck would be expected to be much lessened.

ENGINEERING NEWS

A Journal of Civil, Mechanical, Mining and Electrical Engineering

Published every Thursday by

THE ENGINEERING NEWS PUBLISHING CO.

220 BROADWAY, NEW YORK

BRANCH OFFICES

CHICAGO: 1636 Monadnock Block
WASHINGTON, D. C.: Home Life Building
ATLANTA: Candler Building
RUDOLPH MOSSE, BERLIN AND HAMBURG, GERMANY
Z. P. MARUYA & CO., Ltd., TOKYO, JAPAN

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A wise limitation of the supervision over public-service corporations has been made by the State of New York Public Service Commission, Second District, in a recent decision. Certain applications of an electric light and power company, for approval of an issue of new securities, came before the Commission, and opposing interests raised the point that the company was already over-capitalized, wherefore the Commission should not authorize further capitalization until it had investigated the value of the company's property and compared it with the capitalization and indebtedness. The Commission, however, took another view of its duty, based on the principle that its primary object must be to promote the efficiency of the service rendered to the public by such corporations. A company, says the Commission in substance, may have erred greatly in the past by wasteful management, improper accounting and inflated capitalization, but if the Commission were to take cognizance of these past conditions and because of them refuse to permit the issue of further securities, it would in many cases prevent the raising of money for improvements necessary to enable the company to give proper service to the public.

The bridges for track elevation work in Chicago present a great variety of designs, each railway having its own systems of construction. As a rule, through plate-girder spans are used, with floors of varying design. Self-sustaining floors composed of troughs which form girders or beams in themselves, are used in many cases where there are numerous tracks and where provision is required for switches and crossovers, so that girders rising above the tracks are inadmissible. The headway being limited, deck bridges cannot be used, and for the same reason shallow floors are desirable. Under these limiting conditions, the spans are very frequently subdivided by intermediate supports on the curb lines and in the street.

One curious feature in some of these structures is that two different systems are employed for a single bridge or subway. This is due to the fact that in some cases two railways occupy parallel and adjacent right-of-way so that their bridges form practically one structure. Where both roads use steel structures, the differences in design do not as a rule affect the general appearance of the bridge as a whole. But when (as in a recent case) half of each intermediate support in the street is a concrete wall pierced with arched openings, while the other half consists of steel columns and girders, the appearance is incongruous and unsightly.

Most of the bridges, of course, are of steel construction. Perhaps the most interesting development, however, is in the use of spans composed of rectangular beams or slabs of reinforced concrete. These slabs are laid close together to form a solid floor. At first they were supported by steel columns and girders, but in more recent designs the intermediate supports consist of reinforced-concrete walls. This new system of construction is described in another column, together with tests of concrete girder slabs 25 ft. long. The record of these tests forms an important addition to our knowledge of the behavior of reinforced-concrete beams under load.

Bridge floor design is a special feature in the design of bridges crossing public streets, as in the case of track-elevation work. Two important features are to make the floor watertight and to reduce the noise resulting from the passage of trains. Steel trough floors, and deck floors of steel plates carried by I-beams, have been used extensively, both with and without ballast. Where no ballast is used, the thundering sound as a train crosses the bridge is liable to frighten horses near or passing under the bridge. The noise is, of course, aggravated where through plate-girders are used. In a number of cases, the floor consists of transverse I-beams covered with a deck of planking to carry the ballast. A development of the steel-and-plank deck is a concrete deck. The concrete may be filled between the I-beams and against the girders, so that it becomes an integral part of the structure; or it may take the form of a concrete slab laid upon the floor system and having curb walls to retain the ballast. All these various systems, together with other modifications, are in use. In the new type of reinforced-concrete structure which is mentioned above, the difficulties due to waterproofing and noise would seem to be reduced to a minimum. The slabs or beams are laid close together and have the upper surface slightly inclined. When this solid surface is covered with a sheet of waterproofing material, any water passing through the ballast would drain easily to gutters provided at the ends of the bridge. The floor of massive concrete slabs would be practically noiseless in itself, due to its absorption of vibrations, and the ballast acts as a further noise deadener by dissipating the vibrations before they reach the floor.

An unexpected danger with serious possibilities which affects ballasted solid floors has recently been pointed out by a bridge engineer. This danger lies in the fact that some time during the life of the structure, track maintenance gangs may put more ballast on the floor than it was designed to carry. The floor may thus be subjected to a considerably increased load In resurfacing and reballasting, the maintenance forces are not limited by a fixed track grade over the bridge, as they are in case of open floors, and only by special care will they be able to maintain the original grade without change. It is quite possible that in this way the depth of ballast may in time grow enough to put a considerable excess of weight on the bridge, the more so if the allowance figured on in the design was not much more than the minimum depth of ballast. Since there is nothing in the appearance or arrangement of such bridge floors to automatically fix the track level, or even to make it easy for maintenance gangs to find the proper level, the matter needs to be watched for by the bridge and maintenance engineers. Possibly the danger may be largely removed, in the case of a new design, by providing a coping (or, in case of girders rising above the track level, an offset or other permanent and obvious feature of the girders) approximately level with top of rail. Such a device would be a constant and obvious guide to maintaining the proper limit of ballast depth.

The use of groundwater pumping to facilitate excavation in difficult soil is so rarely employed that we feel special pleasure in reporting two separate examples of such work in this issue: the sewer work at Gary, Ind., and the pier foundations at Chicago. In spite of its infrequent use, the method is by no means one of last resort, a device outside the field of ordinary construction. The successful work at Gary in constructing a deep sewer through what must be classed as very difficult ground indeed, amply demonstrates the simplicity of the method. It is true that not all of the complications which may attend groundwater pumping are clearly apparent in this case. But with abundant pump capacity and a sufficiently close grouping of wells good results are almost certain. The cost of the process does not restrict it to large and elaborate undertakings, as the cost-figures of this job indicate. Even a contract of moderate size, with very simple plant of machinery, can afford to employ the method.

THE DESIGN OF THE QUEBEC BRIDGE.

Mr. C. C. Schneider's report on the design of the Quebec Bridge amply confirms the general opinion with which that ill-fated structure has been regarded since the searching investigations of the Canadian Government's commission of inquiry. The Commission found that the bridge had turned out to be some 20% heavier than was contemplated by the stress-sheets. Although the collapse was shown to be due to quite another cause, such an overrun of dead weight, in a structure whose own weight constitutes by far the largest part of the load it has to carry, is unavoidably fatal. With the bridge fully completed and in service, the stresses would have risen to the limit of strength of the members, and if it did not at once fail, it could at best stand trembling on the verge of collapse.

The computed percentages of excess stress, which we have quoted in another column from Mr. Schneider's report, reveal this clearly enough, though the actual stress figures themselves are rather more striking. To have reproduced the whole series of stress tables given in the report would have transcended due limits of space, but in this place we may present as typical illustrations two selected examples, a compression and a tension member, respectively. One of these is the famous lower-chord member in the ninth panel from the anchorage (second panel of the anchor arm counting from the main pier), the member whose failure by buckling brought about the fall of the bridge. The other is the top chord of the cantilever arm directly adjoining the main pier. The figures of total stress give a picture of the relative importance of dead and live-load, while the unit-stress figures represent directly the tax on the metal. In considering the latter, it is convenient to remember that the elastic limit of the steel—its real or virtual failure point—is not far from 30,000 lbs. per sq. in. But the figures below, while they do not quite reach this point, really exceed it because they contain no allowance for the numerous minor effects, the so-called secondary stresses.

	Anchor Arm Lower Chord, Panel 9.	Cantilever Arm Upper Chord, Panel 10.
Section, sq. ins.	781	669
l/r	42.2	...
Total stresses, thousands of pounds:		
Dead-load	−13,630	+11,950
Live-load	+43	+3,760
	−4,021	+930
Snow	−1,025	
Wind	−7,370	+1,140
Unit stresses, pounds per square inch:		
D + L + S	−24,000 (21,200)	+24,900 (21,100)
D + 1½ L + S + ½ W	−29,700 (24,000)	+28,300 (24,000)
Erection, Aug. 29, 1907	−16,800	+17,500

The figures in parentheses are the stresses which were permitted in these members for the respective load-combinations, under Mr. Cooper's

specifications. Mr. Schneider's estimate of the highest stress intensity compatible with bare safety is not far different from these specified stresses, in the case of the eyebar chord; but for the compression chord his values are lower by some 4,000 lbs. per sq. in.

We need do no more than point to the fact that in the eyebar chord the stress even under the working load, and without wind, is higher by 1,000 lbs. per sq. in. than the extreme or emergency strength estimated by Mr. Schneider. Still worse, in the compression chord, whose emergency strength is valued at slightly less than 20,000 lbs. per sq. in., the working load causes a stress of no less than 24,000 lbs., and the stress under extreme load rises practically to 30,000 lbs. per sq. in., fully one-half higher than the extreme assignable strength.

Let it be remembered that Mr. Schneider's figures for limits of permissible stress are intended as real limits, and would by no means be defensible or admissible in the design of a bridge. *"The writer does not advocate these high unit-strains,"* we read in the report. And while this warning is unobtrusive, we conceive it worthy of very strong emphasis. Tendencies in recent years toward the regular use of very high unit-stresses in design, even in cases where economy of weight is of no particular importance, receive a sharp but needed rebuke in this brief sentence.

Under the circumstances as revealed by the stress analysis, there will be few to raise objection to Mr. Schneider's statement that none of the material which has been fabricated for the north half of the bridge can be used in rebuilding the structure. The strengthening which would be necessary if the trusses were to be rebuilt on the same outline, but with adequate cross-sections, would have to extend to virtually every part except floor and bracing. Even this extensive work—if it is to be considered feasible at all—would involve so many difficulties that the result could but be an unsatisfactory patchwork. And if patchwork and halfway measures are ever justified, assuredly they must be kept out of the rebuilding of the Quebec Bridge. The engineering world can hardly afford to contemplate the chance of a second Quebec disaster.

The most difficult subject which the eminent bridge engineer who wrote the report had to deal with is, curiously enough, the one which he treats most briefly: the suggestions for a new design. It may be premature to ask for anything very specific in this matter at the present stage, or in any case without giving time and opportunity for exhaustive studies. But the existing design, originated both in general outline and in details by the engineers of the Phoenix Bridge Co., stands criticized, and one looks very naturally for justification of the criticism in the shape of suggestions for better design. Yet we find hardly more than a single suggestion in the report.

An explanation for this which has some force is to be found in the fact that so huge an undertaking as this bridge is by no means susceptible of systematic and progressive designing. The design must, in a sense, be evolved by a process of development, a sort of trial and error method. In a structure of ordinary dimensions the engineer knows in advance all of the limitations which will affect his work, and can allow for them in his planning in advance. But in the present case the limitations appear only as the design unfolds. The necessary arrangement of the details, the limits of manufacturing tools and processes, the shipping limits of weight and bulk, the erection problems, etc., have an influence even on the choice of outline that is easily underestimated; yet their full bearing cannot appear until an outline is adopted and has been elaborated to an advanced stage. The testimony of the Phoenix Bridge Co.'s designers before the Commission gives some idea of these conditions. It seems idle, therefore, to seek a very full statement of governing features as a matter of abstract deduction.

The recommendation of straight chords must enlist general approval, as being unexceptionable in its general reasoning. But it fixes a principle hard to adapt to the original requirement that the maximum underclearance is to be maintained over so great a width as 1,200 ft., two-thirds the span. The two conditions together would produce a remarkably radical design indeed, unless perhaps the changes were begun still farther back and the railway approaches raised to a much higher elevation. If this is true for the present clearance of 150 ft., still more so will it hold if the recent clamor of St. Lawrence shipping interests for increased clearance—to nearly 200 ft., if we recall correctly—is heard with approval. In fact, it is not too much to say that, just as the determinative features of the Phoenix design were fixed by the adoption of sharply-curved chords to meet the clearance requirement, so the principle of straight chords in conjunction with the same requirement would establish the chief characteristics of the new bridge. The single suggestion, therefore, may well appear complete and sufficient for present purposes.

There should be joined to this, we believe, another principle which is clearly inculcated by the report, though Mr. Schneider makes no explicit mention of it. This has for its object the reduction of the high secondary stresses. The calculations show that these stresses attain alarming values—alarming when we consider how destructive they are to economical, and therefore practicable and safe, design. In a bridge of such proportion that each pound of useless metal requires three or four pounds of effective metal for its support, it cannot be tolerated that even 5% of the useful metal should be put out of service by being appropriated for secondary stresses, if this be at all avoidable.

It is true that secondary stresses are inseparable from bridge construction, especially when continuously riveted chords are employed; and the unfortunate fact is that any attempt to make the members stronger to resist the secondary bending, by making them stiffer, defeats its own purpose and actually increases the secondary stress. How high they will be, in proportion to the main stresses, depends, however, to a large extent on the truss outline or network. We believe it may be said broadly that two things are most influential in contributing to high secondary bending stresses: flexibility of the truss system as a whole, and short length of panel. The former creates large angular distortion, while the latter concentrates the distortions. Relief from high secondary stress may therefore be sought by making the truss system rigid and by employing long panels. The former is promoted to some extent by straight chords, still more by increased truss depth; and the profile of the Quebec Bridge clearly evidences that the shallow depth of the structure causes relatively high flexibility. The effect of long panels is obvious.

Secondary stresses of the intensities as existing in the original Quebec design must, in our opinion, be eliminated in a new design. To this end the two expedients of (1) increasing the depth of truss, and (2) employing larger panels—in the trusses, not necessarily in the floor-system—must receive primary attention in the work of outlining the new bridge.

LETTERS TO THE EDITOR.

Elimination of Friction in Hydraulic Testing Devices.

Sir: In view of the recent articles in your columns relating to packing friction in hydraulic testing machines, permit me to call attention to the feasibility of practically eliminating such friction by using such a method of construction as to avoid the use of packing. The method consists in making the piston with a long, close fit in the cylinder, and using oil instead of water for the working fluid. To many persons this might not at first thought seem a practicable method, and indeed it seemed unpromising when first considered by the writer, about 18 years ago. However, a testing machine constructed on this principle at that time proved a most satisfactory piece of apparatus, and it has been in frequent use ever since, requiring no alteration or repairs, so far as this feature is concerned. A full description of the machine is given in the Transactions of the American Society of Mechanical Engineers, Vol. XVII., p. 96. The machine was designed for testing the friction of screws, and the special requirement was that the piston should both slide and rotate without appreciable friction while exerting a thrust of 20,000 lbs. upon the screw to be tested. These requirements were satisfactorily met by the design. The piston was 6 ins. in diameter, 6¼ ins. long; the cylinder wall was 1½ ins. thick. Both parts were of cast iron and they were used with their axis horizontal. The fitting was done in an ordinary lathe, finishing by grinding. The diameter of the piston was from .001 to .002 in. smaller than the bore of the cylinder. This is, however, an unnecessarily loose fit; much better results would be obtained in a modern grinding lathe. The oil used was a mineral oil known as "heavy machinery oil," somewhat thicker than engine oils, but less viscous than steam cylinder oils. Animal oils could not be used because of gumming. The pressure was applied, as required, by a hand pump. The most satisfactory pressure gage proved to be a cylinder of about ⅜-in. bore with a nicely fitted piston. The arrangement was similar to the main piston and cylinder; this was set with axis vertical and the piston was weighted as required. Of course all this requires careful workmanship, but the extra care is amply repaid by the accuracy of test results and the permanence of the apparatus.

After the tests of screws, described in the paper referred to above, the machine was used for various other experiments, including tests for the friction of pivots. In the latter case the piston exerted the thrust on the rotating pivot, and also indicated the frictional torque of the pivot by its tendency to rotate with the pivot. Under a load of 10,000 lbs. the frictional torque of the pivot, indicated by the deflection of a pendulum, was sometimes as low as 12 in.-lbs.; but even this small torque was indicated with great accuracy, the piston offering no appreciable resistance to slow rotation, as was shown by small oscillations of the pendulum past the point of mean deflection. The film of oil between the cylindrical surfaces kept the piston and cylinder out of contact, and at the same time the viscosity of the oil in the film prevented excessive oscillations which might otherwise arise from variations of the pivot friction.

The film was first formed by rotating the piston by hand by a device provided for the purpose, but after being formed it generally persisted for an hour or more without further attention. An apparatus of this kind was previously used for pivot tests by Beauchamp Tower in his famous experiments for the Institution of Mechanical Engineers.

Some peculiar properties of fluid films such as that between the cylindrical surfaces were investigated experimentally by the writer. The results were given in a paper entitled "Experiments with an Air-Lubricated Journal," published in the "Journal of the American Society of Naval Engineers," 1897, Vol. IX., No. 2, also in the "Journal of the Worcester Polytechnic Institute," March, 1900. The experiments proved that even as light a fluid as hydrogen could be made to form a separating film by rotation of one surface relatively to the other, and led to a fuller appreciation of the reasons for the formation and persistence of the film of viscous oil in the testing machine.

To return to the construction of cylinders and pistons for testing machines: apparently such parts, made of steel for greater rigidity, and of greater diameter and length of fit than those described, should be quite practicable for machines of great capacity. The leakage of oil past the piston, which inevitably occurs to some extent, was very slight in the apparatus described above. This leakage must of course be supplied by the pump if constant load is to be maintained. The leakage is proportional to the pressure, to the diameter of the cylinder, and to the cube of the film thickness; it is inversely proportional to the length of the piston fit and to the coefficient of viscosity of the oil. Leakage is reduced by good fitting, by thick oil, by great length of piston, and by rigidity of the cylinder, the latter quality opposing the increase of diameter due to the fluid pressure. It should even be possible to partly offset the stretching of the cylinder by making the piston hollow, admitting the oil from the pressure side and thereby expanding the piston by an amount nearly equal to the expansion of the cylinder. The use of such a cylinder and piston with a similar piston pressure gage, renders calibration easy by comparison of the areas determined from micrometer measurements of the diameters.

Albert Kingsbury, M. Am. Soc. M. E.

Pittsburg, July 6, 1908.

Examining and Licensing Irrigation Surveyors and Engineers in Wyoming.

Sir: I am interested in your editorial note of July 23 and in the recent legislation in Louisiana relating to the registration of engineers and surveyors. Inclosed is a copy of the Wyoming law which may be of interest to you in this connection. As irrigation matters have been under the supervision of a State or Territorial Engineer in Wyoming for more than twenty years, it was not difficult to require those engineers and surveyors who are engaged in a general practice to conform with the provisions of the new law. Examinations were required generally. The good man usually desired to take the examination, while the man of questionable standing

sought to avoid it. At the present time we have within the state 340 licensed engineers and surveyors.

Our law does not provide any way by which incompetents would continue to practice. This was discussed, but as the object of the law is to protect the public and classify the engineers and surveyors, in a way, but little stress was given those who held that those who had heretofore performed work of the kind had a vested right.

As all of the work of this kind finally comes to my office I have had an opportunity to study the result of the legislation enacted a year and a half ago. The work submitted has improved rapidly from the time the law went into effect. Engineers and surveyors generally, within and without the state, indorse our law and there is no doubt as to its value, not only to the profession, but to those who depend on the engineer's work.

It is a good thing, as you say, to have a central office where plans can be inspected. It in like manner improves conditions to have all members of any profession show certain qualifications before being allowed to practice. This has been found to be necessary in medicine and in law. I am satisfied that where any state provides proper legislation along the line of the Wyoming law it will never take a backward step. I regard the Louisiana law as very imperfect. Its main object will not be reached until the next generation at least.

Our Board of Examining Engineers works without compensation. Its expenses are paid by the small fees received. Members of the American Society of Civil Engineers have taken the examinations and those who have never had a great deal of training, but who by experience have become of value to their own communities, have been able to qualify in the first grade at least. The questions asked by the board are of a practical nature and relate to surveying and engineering. We have not attempted to cover the whole field of learning, but have tried to obtain some idea as to the judgment of the applicant for a license relative to questions with which an engineer or surveyor must deal.

I agree with you, therefore, in that there should be a central public office for inspecting and passing upon engineering plans, but this office should be aided by having engineers and surveyors employed in the field who can be held responsible for their acts.

Sincerely yours,
Clarence T. Johnston, State Engineer.

Cheyenne, Wyo., July 25, 1908.

[The legislative requirement mentioned by Mr. Johnston is as follows:

EXAMINING ENGINEERS.

Sec. 28. All engineers and surveyors who shall hereafter perform any field work preliminary to the preparation of an application for permit to use the water of the state or who shall make surveys or do engineering work relative to the utilization or use of water, shall satisfy a board to be known as the Board of Examining Engineers, who shall consist of the State Engineer and two engineers of thorough training and experience, to be appointed by the Governor and serve without compensation, that they belong to one or more of the following classes:

(1) Land Surveyor (Examination, Plane Surveying).
(2) Topographic Engineer (Examination, Plane Surveying and Topographic Surveying).
(3) Hydraulic and Hydrographic Engineer (Examination, Plane Surveying and Hydraulics).
(4) Construction and Designing Engineer (Examination, Plane Surveying, Design of Irrigation Works and Structures and the Computation of Earth Work).
(5) Administrative Irrigation Engineer (Examination, Plane Surveying, Hydraulics, Construction Work, Irrigation Law and Practice).

The Board of Examining Engineers may satisfy itself by conducting examinations or by investigations of the record, training and experience of those who may desire to qualify. In case the Board is satisfied as to the standing of any applicant it shall issue a license, upon payment of a fee of five dollars, which shall be applied to cover the expenses of said Board; said license shall be signed by the President of the Board and attested by the Secretary under his seal. The Board of Examining Engineers shall in all cases make inquiry relative to the moral character of every applicant for a license and no license shall be issued to any applicant who is incompetent, dishonest, intemperate or addicted to any habit which would, in the judgment of the Board, render him an unsafe employee of any citizen, corporation or association of the State. Any engineer or surveyor who may qualify under any one or under any number of the classes specified herein, who shall indicate by the character of the work he performs that he is not capable of carrying on such work as set forth in his license, or who becomes morally unfit to practice under any class, may be disqualified and his license revoked. The State Engineer is hereby authorized to refuse to accept any and all work of those who do not avail themselves of the benefits of this section.
(Chap. 86, S. L. 1907.)

[While this law, in a state like Wyoming, must result in the examination and licensing of a considerable percentage of the engineers of the state, yet it differs from the Louisiana law, and those proposed from time to time elsewhere, in that it is limited to engineers who have occasion to do work involving water rights. It is one thing for a state to say that no one shall practice as an engineer unless he holds a license to do so and quite another to require licenses as a condition to having the state recognize the engineer as such when he or his employer submits an application for a state department for approval.

In Wyoming, licensing is a part of the machinery provided for conserving and equitably dividing one of the natural resources of the state. As such, it is necessary that it apply to all engineers engaged in a certain class of work, regardless of how long they have been in practice.

We quite agree with Mr. Johnston that the Louisiana law is very imperfect: not so much because it applies to would-be engineers, only, as because the difference between the prescribed examinations for surveyors and for engineers is so slight, or at least so indefinite. Altogether, the Wyoming legislation is much better designed to suit its end than is the Louisiana; largely, no doubt, because it has a very specific instead of a broadly general object in view, and readily perceived reasons for justifying its existence.—Ed.]

The Salaries of Engineering Graduates: Another Story.

Sir: The article by Mr. Walter H. Snow, on salaries of engineering graduates of five years' standing, in your issue of July 23, is of peculiar interest to me, who graduated from a good school about five years ago.

From my reading of the article I gather that approximately 200 graduates of some school five years after graduation are getting about $2,000 per year on the average. My opinion is that the graduate in reporting to Mr. Snow "watered their stock," and it is my opinion that if the whole bunch of "five-year-olds" were gathered together they could be hired in a lump for about $1,400 each per year.

I am now employed in the engineering department of the largest company of its kind in the world. In this office are 14 engineers whose average salary is not over $30 per week, and at least three of these engineers are graduates of over ten years' standing and directly responsible for work running into millions of dollars per year. The rest of the men are of just about five years' standing (after graduation) and their salary is not over $25 per week on the average. This average will apply to more than 75 engineers of five years' standing employed by the same company.

This is a special case, of course, but here is another instance: A couple of years ago, by reason of a consolidation, a considerable number of experienced engineers were on the market. In flush times, and backed by all the machinery of a powerful organization, $2,000 was more than any one of them could obtain, and most of them are now with the same old company at, I should say, about $1,500 per year.

For one year I worked for one of the largest coal-carrying railroads in this country as engineer in charge of bridges on a division in the mountains. The salary of the division engineer of 25 years' standing was less than $2,000 per year.

I spent two years working on water power work in a distant country. Towards the close of the last year I had occasion to work for a "consulter" (the biggest show of the kind in America). In a confidential talk with a millionaire promoter the "consulter" informed him that the most he paid his "very best" men in any capacity in any land was $150 per month and they *maintained* themselves.

The chief engineer of a large commission said he would not pay a young engineer over $18 per week on inspection work, and he could get all he wanted for less.

The "tragedy" comes in when some of us who borrowed money to pay for our education are asked by those who helped us "how about it?" Mr. ——, says that five years after graduation you should be getting $2,000 per year. Certainly you can live on one-half of that and repay those who sacrificed to help you, and who are now getting old and need the money. You reply that Mr. —— average salary has missed you by about 50%. They then say we thought you had brains, but see you have not and we are "stung." The reply is that you are in charge of responsible work for the largest company in the world, but you do not get any more than any one else doing the same work. Something is wrong somewhere.

I do not wish to cast any reflection on Mr. Snow's statements, but I do wonder how many affidavits were sent along with the salary statements.

The discussion now going on among "Engineering Educators" on "How Shall the Technical Schools Fill the Wants of Three or Four Trusts" is a very refreshing one. I am gathering opinions on it from some of the recent victims of this policy.

If there is anywhere in America or elsewhere a place paying graduates of five years' standing $2,000 per year don't tell where it is for the rush to the Klondike will be outdone.

Yours, $1,400.

July 27, 1908.

Ashes as Fuel.

Sir: In connection with your articles on the subject of ash burning, the enclosed advertisement from a theater program in a large Eastern city will probably be of interest to you.

Very truly yours,
A. D. Morris.

New York City, July 18, 1908.

[The advertisement in question, with the name of the promoters omitted, is as follows:

BURN UP YOUR ASHES.

The city of New York saves $50,000 a year by burning ashes.

Our product, which is similar to the one used in New York, saves you ⅓ of your coal bill.

Come in or send 50 cents for enough to treat 500 pounds ashes.

Two Sizes—50c. and $1.00.

Come in and see Demonstration.

This confirms our past contentions that the malign influence of the practice of the Board of Education, in forcing firemen to reburn ashes, is more than local. The quotation of $0.50 for chemicals to treat 500 lbs. of ashes suggests an interesting comment on the cost of the oxalic acid-salt hoax. It has been found that about 1 gal. of liquid will sufficiently moisten 1 cu. ft. of cinders, weighing approximately 40 lbs., so that dust will not fly in shoveling. With rock salt at 65 cts. per 100 lbs. and oxalic acid at 6½ cts. per lb., the cost of chemicals for 500 lbs. of cinders would be about 18 cts. According to the appended advertisement there is not as heavy a profit as might have been suspected. If the coal burned shows, on analysis, 10% ash, which is a common figure, and if the cinder is 50% fixed carbon, which is not very high, then the purchaser of the magic compound needs to pay about 50 cts. extra per ton of fuel bought. The cost of the chemicals can be eliminated and the wasted carbon can be recovered if the firemen of the small plants would give some adequate attention to dampers, grates and methods of firing and perhaps to sifting the ashes to recover unburned coal.—Ed.]

THE DESIGN OF THE QUEBEC BRIDGE: REPORT BY C. C. SCHNEIDER, WITH THEODORE COOPER'S SPECIFICATIONS.

To supplement the exhaustive investigation of the collapse of the Quebec Bridge, which was carried out by a governmental commission of engineers and has been fully reported in these columns (see Eng. News March 12, 1908, to April 30, 1908), the government of Canada directed a full investigation of the Phoenix Bridge Company's design. This investigation was entrusted to Mr. C. C. Schneider, Past-President Am. Soc. C. E. The Quebec Bridge Commission was concerned directly only with those matters that related to the collapse of the structure, and was not required to deal with those parts of the design that did not affect the collapse. But the government was vitally interested in the future of the bridge as well as in its past, and was no less desirous of knowing whether the design was satisfactory and, if not, what were its defects, than of learning the circumstances of the failure.

Mr. Schneider's report, a document of great interest, has now become available, through its publication in the same volume with the commission's report, just issued in printed form.

Mr. Schneider deals with the specific questions submitted to him in a very concise report. More extensive results and studies are contained in several appendices. An important feature of the report, further, is the fact that Mr. Theodore Cooper's specifications for the design and construction of the bridge, which up to the present have not been published, are printed as Appendix A. The three other appendices contain:

A tabulation of component and combined stresses in all the members of the bridge.

A monograph on the Theory of Columns.

A discussion of Secondary Strains in the Trusses of the Quebec Bridge.

To preface our abstract—necessarily brief, as

compared with the original—of this report, we reproduce in full the specifications which Mr. Cooper drew to govern the design and execution.

Theodore Cooper's Specifications for Loads and Strains, Quebec Bridge.

FLOOR SYSTEM.

Railroad Stringers.—To be designed to carry Cooper's E-40 engines with unit strains not exceeding 10,000 lbs. per sq. in. of net section.

Trolley Stringers.—Loaded with cars weighing 56,000 lbs. on two axles 10 ft. apart, not to be strained above 13,000 lbs. per sq. in. of net section. Cars 30 ft. over all.

Highway Stringers.—Loaded with 24,000 lbs. on two axles 10 ft. apart, strains not te exceed 15,000 lbs. per sq. in. of net section.

Transverse Floor Beams.—With all tracks loaded as above they must not be strained above 15,000 lbs. per sq. in. of net section, or 12,000 lbs. with both railroad tracks loaded.

The webs of all girders shall be considered as resisting shearing strains only and will not be estimated as doing any flange duty.

TRUSSES.

The maximum strains produced by the following live-loads and wind shall be used for proportioning all members of the trusses or towers:

1. A continuous train of any length weighing 3,000 lbs. per ft. of track, moving in either direction on each track.

2. A train 900 ft. long consisting of two E-33 engines followed by a load of 3,300 lbs. per lin. ft. upon each railroad track and moving in either direction.

3. A train load 550 ft. long consisting of one E-40 engine followed by 4,000 lbs. per lin. ft. of track, on each track.

4. For the suspended span a lateral wind force of 700 lbs. per lin. ft. of the top chord and 1,700 lbs. per lin. ft. of the lower chord, one-half of which shall be used for lateral and diagonal bracing.

For the cantilever and anchor arms a lateral force of 500 lbs. on the top chord and 1,000 lbs. on the lower chord, per lin. ft. in addition to the wind force on the suspended span, shall be considered.

Only one-third of this maximum wind force need be considered in proportioning the chords. It shall be considered as a live-load. Unless this increases the strains due to the live and dead loads only more than 25% the sections need not be increased.

Reversal of strains by the wind acting in opposite directions need not be considered; but where the maximum wind forces reverse the strains in any member the member must be designed to resist each kind of strain.

Allowed Working Strains.—Under the above working loads in combination with the dead loads, the allowed strains in all members of the trusses and towers shall not exceed the following limits:

Tension Chords and Diagonals.—

$$12{,}000\left(1-\frac{\text{Min.}}{\text{Max.}}\right)\text{ lbs. per sq. in of net section.}$$

Compression Chords.—(Where l does not exceed 50 r.).

$$12{,}000\left(1+\frac{\text{Min.}}{\text{Max.}}\right)\text{ per sq. in.}$$

Main Posts.—

$$\left(12{,}000-50\frac{l}{r}\right)\left(1+\frac{\text{Min.}}{\text{Max.}}\right)\text{ lbs. per sq. in.}$$

TRUSSED FLOORBEAMS.

Tension Struts.—

$$10{,}000\left(1+\frac{\text{Min.}}{\text{Max.}}\right)\text{ for R.R. loading.}$$

$$12{,}000\left(1+\frac{\text{Min.}}{\text{Max.}}\right)\text{ for total loading.}$$

Compression Struts.—

$$\left(10{,}000-40\frac{l}{r}\right)\left(1+\frac{\text{Min.}}{\text{Max.}}\right)\text{ for R.R. loading.}$$

$$\left(12{,}000-50\frac{l}{r}\right)\left(1+\frac{\text{Min.}}{\text{Max.}}\right)\text{ for total loading.}$$

WIND STRUTS AND LATERALS.

Tension.—20,000 lbs. per sq. in.

Compression.—$20{,}000-90\frac{l}{r}$ per sq. in.

For counters and intermediate posts, the live load on the railroad tracks shall be increased 15%.

COMBINED AND REVERSED STRAINS.

The allowed positive and negative strains upon any member subject to any combination of $\pm D$, $\pm L$, $\mp L'$ shall be determined by the following formulae:

$$\text{Allowed} + \text{strain, } 12{,}000\left(1+\frac{D-L}{D+L+L'}\right)$$

$$\text{Allowed} - \text{strain, } 12{,}000\left(\frac{L'}{D+L+L'}\right)$$

PROVISION FOR FUTURE INCREASE OF LIVE LOAD.

In addition to the previous provisions as to the working loads and strains, no member of the trusses or towers shall be strained to exceed three-quarters of the elastic limit under the extreme assumption of an increase in the train loads of 50% above those previously specified. Or, not to exceed 24,000 for the chords and main diagonals, or $24{,}000-100\frac{l}{r}$ for the posts.

The material to be medium steel of the best quality and made by the open-hearth process.

All details, proportion of parts, workmanship, etc., to be in accordance with the best accepted practice.

Corrected to date, March 2, 1904.

Appenda. June 13, 1905.

For the cantilever arms, the full wind on the suspended span should be considered.

A snow load of 1,000 lbs. per ft. of bridge should be used.

In applying these specifications to check the design, Mr. Schneider makes the following interpretations:

a. The value of $\frac{max.}{min.}$ by which the permissible unit-strains are determined is derived from the dead and live-loads only; but in proportioning the members these unit-strains shall be used for the sum of the strains from dead, live and snow loads.

b. As the specifications require that "only ⅙ of the maximum wind force need be considered in proportioning the chords," and nothing is mentioned in reference to the web system [of the main trusses—Ed.], this also applies to wind strains in web members.

c. In the formulas under the head of "Combined and Reversed Strains," L' denotes the live-load strain of opposite sign from that of the dead-load; the expression $D - L'$ is the arithmetical difference between these strains; and $D + L + L'$ is the arithmetical sum of these strains.

As the terms of the appointment under which Mr. Schneider acted were not altogether specific Mr. Schneider sets himself the following questions, which his report answers:

1. The sufficiency of the present plans of the Quebec Bridge, as to their conformity to the specifications as approved by the government.
2. The advisability of modifications in the present plans, should they be found inadequate, using as far as practicable the fabricated material now on hand.
3. The advisability of discarding the present plans of the Quebec Bridge, and recommendations as to a new design.

Much of what the author says in discussing these questions is of general bearing, beyond its application to the particular structure considered, and as it comes from a bridge engineer of highest standing and long experience both in design and in manufacturing, it will have added value.

Does the Design Satisfy the Specifications?

The answers to this question, resulting as to the trusses from the stress tables appended to the report, may be summarized categorically.

The floorbeams and stringers, the lateral and sway bracing of the trusses, and the bracing of the floor-system, satisfy the specifications. The details and connections of these members also satisfy the specifications.

The trusses do *not* meet the specification requirements, because the assumed dead-load was considerably lower than the actual weights. [The amount of the excess of weight, and its causes, were fully discussed in the Commission's report. See Eng. News March 19, 1908, p. 308, and April 16, 1908, p. 422.—Ed.]

The actual unit-strains in most of the members of the trusses exceed the limits of the specifications. In the upper chords of the cantilever arm * * from 10 to 18%; and in the lower chords * * from 7.5 to 24%. In the upper and lower chords of the anchor arms, the unit strains in all panels exceed these limits from 11 to 20%. The unit-strains in the chords of the suspended span also exceed the limits of the specifications, the upper chords 16 to 18%; the lower from 7½ to 9½%. While the strains in some web members come within the limits, in some cases they are in excess as much as 21%, and in one case 57%.

The details are generally in proportion to the members which they connect and in accordance with good practice. Many of the compression members, however, are defective because their connections, such as the latticing, are not sufficient to make the parts composing the member act as a unit.

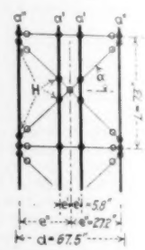
The most pronounced defect in this respect exists in the lower chord members of the cantilever and anchor arms. These members consist of four separate ribs not particularly well developed as compression members, and their connections to each other are not of sufficient strength to make them act as a unit.

This subject is further studied by Mr. Schneider only to the extent of analyzing the required lattice section and riveting, in connection with the appendix on Theory Columns. The general criticism above is not detailed or analyzed as regards either a better development of the ribs or proper connections other than the lattice; nor are the broad questions of (1) best arrangement of section in very large columns and (2) proper connections between abutting members, given detailed consideration.

To explain the criticism of the lattice, the following extract from the appendix mentioned may be interesting. It represents an application of formulas derived from a theoretical study of column shear.

LATTICE REQUIRED IN BOTTOM CHORD 9 OF ANCHOR ARM.

The top latticing as sketched [see drawing 1 with—Ed.] in Fig. 21 (the circles indicating rivets) will first be considered.



The latticing angles between the outer and inner web practically form a complete system, only insignificant bending on the ribs being caused by the center lines of the diagonals not meeting at the center line of the ribs. We can apply formula 8* to find the area which would be required in these angles, assuming hinges at points H.

Let it be assumed that the actual area has been found by the formula $16{,}000-70\frac{l}{r'}$, where r' is taken parallel to the web. This area must be multiplied by $\frac{16{,}000-70\frac{l}{r'}}{16{,}000-70\frac{l}{r}}$ in order to find the area a required for buckling laterally. The actual area is 781 sq. ins., $r = 19.7$ ins., $l = 684$ ins., $r' = 16.1$ ins. Therefore

$$a = 781\,\frac{13{,}000}{13{,}000} = 746 \text{ sq. ins.}$$

and $a' = a'' = \frac{a}{4} = 186.5$ sq. ins.

$e' = 5.8$ ins., $e'' = 27.2$ ins., $d = 67.5$ ins., $L = 73$ ins.

$M'' = a''\,e'' = 5{,}070.$

$$S'' = 8 \times 70 \times \frac{5{,}070 \times 73}{67.5 \times 19.7} = 156{,}000 \text{ lbs.}$$

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*Formula 8 is

$$A = \frac{S''}{k}\,\text{cosec}\,a = 8\,\frac{c}{k}\,\frac{M''\,L''}{d\,r}\,\text{cosec}\,a$$

in which A = cross-sectional area of lattice bar total for top and bottom planes of lattice.

S'' = longitudinal shear between inner and outer rib for one panel-length L'', given by the expression $S'' = \frac{S\,M''}{a\,r^2}\,L''$,

S being the total transverse shear.

L'' = panel length of lattice between inner and outer rib, but in this calculation taken equal to L, thus including the stress of two lattice-bars.

k = yield-point in tension, or reduced yield-point for compression.

c = constant of reduction term in straight-line column formula.

c/k = constant for a given bar, which may be taken from a column formula for working load instead of a formula for ultimate load. The author uses $c/k = 70 \div 16{,}000$.

M'' = static moment of outer rib about middle axis, or $M'' = a''\,e''$.

d = width of column out to out, in plane of latticing.

r = radius of gyration of column, in plane of latticing.

This formula is derived for a four-rib column from the general equation for column shear which Mr. Schneider deduces on the assumptions: (1) that the deflected column axis is parabolic, (2) that the reduction factor of the column formula expresses the difference between the maximum stress in the extreme fiber and the average stress, and (3) that the load is applied centrally to the ends. This shear equation is

$$S\ max. = 8\,c\,\frac{a\,r}{d}$$

where a is the total area of the column, or rather the total area that would be required for the l/r in the plane of the lattice.—Ed.

Area of one diagonal required

$$A \text{ net} = \frac{1}{4}\frac{156{,}000}{16{,}000} \times 1.4 = 3.40 \text{ sq. ins.}$$

[for tension.—Ed.]

$$A \text{ gross} = A \text{ net}\ \frac{16{,}000}{13{,}700} = 3.97 \text{ sq. ins.}$$

[for compression.—Ed.]

Actually used: 1 angle $4 \times 3 \times \frac{5}{8} = 2.5$ sq. ins. gross $= 1.1$ sq. in. net, as one leg of angle is cut off at the intersection at center.

Number of ⅞-in. rivets required in one angle,

$$N = \frac{4}{3}\frac{3.40}{0.6} = 8.$$

Actual number of rivets used = 2.

Between the inner ribs there is no complete lattice system; the intersecting diagonals have to transmit the longitudinal shear S' of one panel-length L, which can be found by formula 9.*

$$M' = \frac{a}{4}(e' + e'') = 6{,}060.$$

$$S' = 8 \times 70 \times \frac{6{,}060 \times 73}{67.5 \times 19.7} = 186{,}000 \text{ lbs.}$$

Area of one diagonal required,

$$A \text{ net} = \frac{1}{4}\frac{186{,}000}{16{,}000} \times 1.4 = 4.07 \text{ sq. ins.}$$

Actual effective area as above = 1.1 sq. in.

Besides there are secondary strains in the lattice angles owing to their continuity, the riveted end connections, and the presence of the lateral struts.

The rivets at the inner rib have to transmit the shear

$$S' - S'' = 30{,}000 \text{ lbs.}$$

Their number should be

$$N = \frac{1}{2}\frac{4}{3}\frac{30{,}000}{16{,}000}\frac{1}{0.6} = 2 \text{ rivets, } \tfrac{7}{8}\text{-in. diam.}$$

Actually used, 2 rivets ⅞-in. diameter.

In consideration of these results, the lattice diagonals and their connections are decidedly too weak. It is evident that even under conservative loads certain parts must have been overstrained.

The bottom lacing is somewhat better. The tie-plate at the intersection of the angles takes the longitudinal shear and is connected by 4 rivets to each rib.

Is the Design Sufficient Independend of the Specifications; What Unit Stresses May be Allowed?

While the design, as shown, involves stresses exceeding those allowed by the specifications, it might still be safe for the intended service, in case the specified stresses are low enough that they may be exceeded without producing risk of failure. Mr. Schneider, therefore, has considered the question of permissible unit-stresses.

Adopting the plan of considering two alternative load conditions—a regular working load and a merely possible emergency loading—as found in Cooper's specifications for the bridge [and as also used for the large East River bridges at New York City since the report of Morison, Schneider, Merriman, Hodge and Cooper (Eng. News March 12, 1903, p. 243) on the Manhattan Bridge plans in 1903.—Ed.], Mr. Schneider seeks to determine what unit stresses may be considered the highest permissible, for the two conditions. That is, he seeks to fix a limit of safe working stress and a limiting emergency stress. The argument by which these values are deduced is worth careful study:

The strains produced by the working load, which is by no means excessive, should leave a reasonable margin for safety. The strains produced by the extreme loads should remain within the elastic limit of the material.

EYEBARS.—The elastic limit in full-sized annealed eyebars cannot be depended upon to be more than 28,000 lbs. per sq. in. A direct tension of 24,000 lbs. per sq. in., together with secondary strains caused by the friction on the pins during deformation, and the uncertainty of a uniform distribution of the strains over all the bars, may increase the strain to at least 27,000 lbs. per sq. in., which is just within the elastic limit, with practically no margin for safety.

A strain of 21,000 lbs. per sq. in. in direct tension combined with the secondary strains, etc., may produce an extreme fiber strain of about 24,000 lbs. per sq. in., or 6/7 of the elastic limit of the eyebars.

The unit-strains to be allowed on eyebars for direct tension, therefore, should not exceed 24,000 lbs. per sq. in. for the extreme load.

COMPRESSION MEMBERS.—In accordance with the accepted theory of compression members the fiber strain near the center of a column increases in proportion of the length to the least radius of gyration, and, therefore, an allowance must be made for the buckling caused by the tendency to bend.

The usual practice in bridges of ordinary span is to consider the gross section of the compression members in computing their strength. This is generally done in connection with the conservative unit strains of about half of the elastic limit, thus giving a considerable margin for safety; but in the case of the Quebec Bridge, where the unit-strains are unusually high, approaching the elastic limit, the net areas of the members should be used in estimating the safe limit. Some of the compression members consist of sections which are composed of angles and a number of plates riveted together. The rivet holes reduce the sectional area, and, while these holes are filled up with rivets, they do not fill the holes so perfectly as to make them take the place of the material punched out of the rivet-holes. In some of the lower chord members, the net section is about 86% of the gross section, and the elastic limit, which is estimated to be 32,000 lbs. per sq. in., is thereby reduced to about 27,500 lbs. per sq. in. of gross area. If we, therefore, assume the maximum permissible unit-strain on the gross section for the specified extreme loading as 24,000 lbs. per sq. in., and the secondary strains as only 3,000 lbs. per sq. in., or approximately 12½% of the direct strain, the total fiber strain per sq. in. would be 24,000 + 3,000 = 27,000 lbs. This strain nearly reaches the elastic limit of 27,500 lbs. per sq. in. with scarcely any margin for safety.

The maximum permissible strain of 24,000 lbs. per sq. in. for the direct compression caused by the extreme load would have to be reduced in accordance with the accepted formulas for compression members, making it 24,000 — 100 l/r; where l = length and r = least radius of gyration of member.

For the working load there should be the same margins for safety as in tension members. As stated before, the elastic limit in compression members, owing to the reduction of their sections by the rivet-holes, may be reduced to 27,500 lbs. per sq. in. of gross section. Deducting 3,000 lbs. per sq. in. for secondary strains would leave 24,500 lbs. per sq. in. on the gross section as the maximum strain in direct compression within the elastic limit. Allowing 6/7 of this strain the same as for tension members, we have 21,000 lbs. per sq. in. as permissible strain for direct compression, which should be reduced by the usual formulas, making it 21,000 — 90 l/r. These limiting strains should be applied to all compression members. The writer does not advocate these high unit-strains, but only desires to fix a limit within which the strains may be considered safe, and which could be used in comparison with the tables in Appendix B.

The extreme unit-strains within which in the writer's judgment the structure may be considered to be able to sustain the loads provided for in the specifications are:

1. For the dead and live loads combined with the snow load: For tension, 21,000 lbs. per sq. in. of net section; for compression, 21,000 — 90 l/r per sq. in. of gross section.

2. For the extreme provision of 1½ times the live-load, dead and snow loads, combined with 1-3 of the wind strains: For tension, 24,000 lbs. per sq. in. of net section; for compression, 24,000 — 100 l/r per sq. in. of gross section.

Applying these maximum values, it is found from the full table of stresses that the *upper chord eyebars* are overstressed for both conditions of loading, except in those panels where erection stresses governed.

The *lower chords*, with three or four exceptions due to this same cause, are also deficient, irrespective of their latticing; the inadequate latticing already studied makes the deficiency still greater, of course.

All but one of the *posts* are overstressed.

About one-half of all the main *diagonals* are overstressed.

The *center posts* [posts over the piers—Ed.] are overstressed.

The stresses in the *hangers* and in the *subdiagonals* come practically within the limits of safety.

The *upper chords of the suspended span* are greatly overstressed [44 to 48% excess], whereas most of the *lower chords and web members* of this span are safe.

Comparison of the stresses as fixed by the specifications for the several members with Mr. Schneider's limits shows that the former do not materially exceed the latter in most of the truss members. However, the specifications do exceed the limits of safe stress deduced above, in the entire lower chord of anchor and cantilever-arms, and in the posts over the piers.

This appears to be due in large part to the

$$\text{effect of the } \frac{\text{min.}}{\text{max.}} \text{ formula for permissible stress.}$$

Mr. Schneider

considers the use of a formula for the permissible strains based on the minimum and maximum strains in each member, as given in the specifications of the Quebec Bridge, to be unsuitable for practical purposes, as it is not supported by facts established by recent experiments, and causes unnecessary complications in the computation of the strength of the members; giving, besides, anomalous results.

Mr. Schneider advocates using a suitable impact allowance to make the live-load stress directly comparable with dead-load stress, and then using a uniform permissible unit-stress for the combined stresses. He is opposed to all methods which pretend to consider the effect of repetition of load, or fatigue.

It is noteworthy that this section of the report restricts itself to the stress specifications and makes no inquiry into the load specifications. There has been considerable criticism of the Quebec Bridge specifications on the score of low loading, with the claim not only that the engine and train weights are unduly light, but also that trolley and roadway loads, and snow and wind, did not enter into the stress totals by which the members were proportioned. In how far these claims are justified may now be determined according to individual opinion, from the precise terms of the specification as above given.

The Amount of the Principal Secondary Stress.

The estimate of 3,000 lbs. per sq. in. for secondary stress, which appears in the above determination of permissible unit-stresses, is based on a calculation of secondary stresses given in Appendix D of the report. This contains first, the outline of a method of calculating the stresses caused (a) by bending of the several members under the distortion of the strained truss, and (b) by the bending due to weight of the individual members; second, a tabulation of secondary stresses in the lower chord members of cantilever and anchor arms for the following loads:

Full dead-load ["d"].
A live-load of 3,000 lbs. per lin. ft. on one truss of the centilever arm and suspended span ["c"].
A live-load of 3,000 lbs. per lin. ft. on one truss of the anchor arm ["a"].
Own weight of lower chord ["w"].

The table gives these stresses in thousands of pounds per square inch. Beginning at the anchorage end, the sum of the stresses due to the first, second and fourth of the above loads, $S_a + S_c + S_w$, has the following values, the bending stress at each end of each member being given:

L1	0	±5.8	C10	∓10.6	±14.0
L2	±5.8	∓5.0	C9	±15.2	∓11.1
L3	∓3.5	±8.8	C8	∓11.1	±15.1
L4	±8.8	∓11.4	C7	±15.9	∓10.6
L5	∓9.0	±17.7	C6	∓10.6	±13.1
L6	±17.6	∓15.4	C5	±13.4	∓6.0
L7	∓15.0	±22.4	C4	∓6.8	±6.4
L8	±21.6	∓17.2	C3	±3.4	∓1.9
L9	∓16.9	±19.4	C2	∓2.2	±4.0
L10	±18.2	∓10.6	C1	±1.0	0

The stress due to the dead-load distortion makes up the larger part of these stresses, of course. Mr. Schneider discusses whether it is feasible to conduct the erection in such a way as to eliminate the secondary stress due to dead-load. To this end it would be necessary that the chord splices should come without restraint into perfect bearing after the full dead-load is on the bridge. He holds that it is almost an impossibility for the shop to work so accurately as to fulfil this condition, especially for a polygonal chord like that of the Quebec Bridge. Even if this result were attained, however, the stress from live-load distortion could not be avoided.

No matter for what condition of loading the length of the members of the trusses may be adjusted to give the joints of the lower chord an even bearing, secondary strains will occur, and it is reasonable to suppose that

[*The same as given in the preceding footnote in defining S'', except that M' and L' are substituted for M'' and L'', M' being the static moment of the entire column half, or $a'' e'' + a' e'$, and L' being the lattice panel length at the inner rib, for a complete lattice system. In the calculation, L is used in place of L', and the stress is distributed over the two lattice bars. Two lattice angles in each plane of latticing, four in all, account for the factor ¼ in the calculation of A net.—Ed.]

at least those produced by the live-load will occur in any case. *These range from 3 to 20% of the total direct strains.*

The total secondary strains may therefore range from the values S_a in the table to the values of $S_a + S_d + S_w$, since S_d (from live-load of anchor arm) is always of opposite sign to S_a.

The greatest secondary strain occurs in member L_6-L_7 of the anchor arm, where it is between 4,600 and 22,400 lb. per sq. in.

The secondary strains in the lower chord are from 18 to 95% of the corresponding direct strains; this percentage is smallest at the ends of the cantilever and anchor arms and increases towards the pier.

In figuring the secondary strains, the pins have been assumed frictionless. A calculation has shown that the strains caused in the lower chord by friction of the pins are negligible, being less than 1% of the secondary strains where the latter read the maximum.

SECONDARY STRESS IN EYEBARS.—The effect of friction of the pins is considerably greater on the eyebars of the upper chord. Approximate computations show that the secondary strains in the eyebars for assumed rigid end connections would be from 30 to 40% of the direct strains. Since for a coefficient of friction of 0.15 the strains caused by this assumed friction amount to about the same as for rigid end connections, it follows that the ends are prevented from turning under any load and the secondary strains can, therefore, amount to the above-given percentages of the direct strain.

It is probable, however, that during erection as well as afterwards, through vibrations from moving loads, the eyebars gradually turn on the pins, thus eliminating partly the secondary strains from the dead-load. The most favorable condition which could be assumed is that the secondary strains are produced by the live-load only. The live-load strains in the upper chord bars are from 25 to 30% of the total strains; hence, if the secondary strains are 40% of the primary strains produced by the live-load, they will amount to at least from 10 to 12% of the total direct strains.

Thus it appears that an allowance of 3,000 lbs. per sq. in. corresponds with the calculated results for the eyebar chord. For the bottom chord, however, it is less than the maximum live-load secondary stress actually found in the Quebec Bridge (20%, see quotation above), and of course far below the total secondary stress due to dead and live-load. This means that the compression values of 21,000 — 90 l/r and 24,000 — 100 l/r which Mr. Schneider fixed as limits of safe load are by no means too conservatively derived. That these limits were considerably exceeded in the Quebec Bridge, therefore, argues the more strongly against the safety of the design.

As to Using the Old Material in Reconstruction.

Mr. Schneider pronounces against the practicability of using any of the old material [meaning that for the north half of the bridge, not yet erected—Ed.] in the reconstruction of the bridge. The floor-system and bracing not being overstressed, the question is how they can be utilized. Strengthening the deficient members of the trusses as built, by adding section, is considered impracticable from a manufacturing standpoint. The lower chords would have to be increased 50% or more, which would mean complete cutting apart and re-assembling with additional material, and of course refacing and reboring. The latter operation alone would make the members unserviceable by shortening them. The reinforcement of the overstressed upper chords by adding new bars, in some panels as many as 20%, would require not only putting in new pins but also changing the upper ends of the posts, which is equally impracticable.

If the existing truss material cannot be reinforced, new trusses of stronger design might be built to the original outline and spacing, so as to permit using the floor and bracing. This Mr. Schneider considers so difficult as to be impracticable. Moreover, he believes that the present design of the trusses can be improved upon, and that therefore

the new design should be worked out on entirely different lines to avoid many of the complications and objectionable features existing in the present design.

In working out a new design, the span length might be retained and the main piers used, but to reconstruct the anchorages the anchor piers would have to be partially rebuilt. The main piers are considered adequate to carry a heavier structure, except that Mr. Schneider does not pass opinion on whether the foundation is sufficient to sustain the increased pressure.

Concerning A New Design

Very brief criticisms and statements make up the recommendations for the general features of a new design. It appears that Mr. Schneider finds no objection to retaining the span length and therefore to some extent the general type of truss. The following is a full reprint of his comments on a new design:

Referring to the features which appear to be objectionable in the present design, the writer begs to call your attention to the following:

The polygonal lower chords of the cantilever and anchor arms are not well adapted for a cantilever bridge on account of the difficulties in fabrication and proper fitting, which make them not only more costly than chords forming a straight line, but also less safe. The polygonal chords of the present design produce a reversal of strains in some web members, which on that account require not only more material than members with strains in one direction only, but also cause unnecessary complications in their details and connections.

The wind forces in a rationally designed bridge should produce strains in the chords, the lateral and sway bracing only. On account of the shape of the chords of the Quebec Bridge, the wind strains affect also the web members of the trusses, producing in these members additional strains, consequently requiring in these members more material and more complicated details.

The writer considers that in a rationally designed structure the strains should be carried in the most direct line to the piers. The more complicated the design and the oftener the strains have to change their direction before reaching their destination, the more assumptions have to be made, which again reduce the degree of accuracy of the results of the computations; therefore, the simpler the design, the safer it will be with the same unit strains.

THE BALTIMORE SEWAGE TESTING Station has been practically shut down. Mr. Calvin W. Hendrick, Chief Engineer to the Baltimore Sewerage Commission, in a report dated July 31, stated that the results obtained "have been most gratifying," and that "the information gathered will enable" the city to save "a large amount of money." A total of 70 acres of land have been cleared at the site of the disposal works; 256,275 cu. yds. of excavation and 181,174 of embankment have been completed.

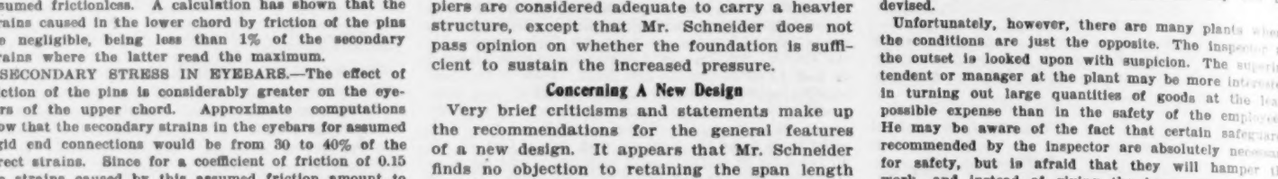
THE PRESERVATION OF SLOPES in earth cuttings and embankments is accomplished on a railroad in Bohemia by the use of locomotive ashes. The slopes of banks which have been washed down are cut into steps 2 ft. or 2½ ft. high and wide, and the profile is then reestablished with a mixture of earth and locomotive ashes, half and half. The new slopes are seeded with grass and 10% white clover, and then planted with young locusts, 40 ins. apart both ways, which make a perfect network of roots but a few inches below the surface. Where the climate is too severe for the locust, the Siberian pea bush takes its place.

THE PERSONAL FACTOR IN CONNECTION WITH THE CARE AND INSPECTION OF BOILERS AND MACHINERY.

By J. W. RAUSCH.†

At some plants care is exercised to keep everything in first-class condition. The work is done in an orderly and systematic manner, and everything possible consistent with the nature of the business appears to be done for the welfare and safety of the employees. It is a pleasure to make an inspection at a plant of this kind, not because the inspection is less thorough, but the inspector knows that if he does find anything which is dangerous and liable to cause accident, such dangerous defects will be remedied if a practical way can be devised.

Unfortunately, however, there are many plants where the conditions are just the opposite. The inspector at the outset is looked upon with suspicion. The superintendent or manager at the plant may be more interested in turning out large quantities of goods at the least possible expense than in the safety of the employees. He may be aware of the fact that certain safeguards recommended by the inspector are absolutely necessary for safety, but is afraid that they will hamper the work, and instead of giving the improvements a fair trial, a letter is liable to find its way to the office of the chief inspector, complaining that the inspector is too critical and is insisting upon impracticable things. Thoroughly competent engineers are sometimes of an exceedingly jealous and sensitive disposition, and are under the impression that their ability is questioned when an inspection is made of the machinery, boilers and other appurtenances, of which they may be in charge. This is all wrong. Banks and trust companies are periodically examined by government examiners, yet no one would question the ability of the officials of the banks and trust companies because of such examination.



ENG. NEWS.

SAMPLES OF SCALE FROM INTERIOR OF A BOILER.

Then, there is the engineer who does things knowing that they are dangerous, but who is reckless and would rather take chances than encounter inconvenience. For example, inspectors often find the governor of an overloaded engine blocked. The engineer knows full well that the belt of an overloaded engine is under its most severe strain and that it is liable to break at any time. He also knows that if the belt does break, the engine will be adrift and race immediately, for the simple reason that with the governor blocked there is nothing to control the speed, and a disastrous fly-wheel explosion is inevitable; and this is only one of the many causes which, combined with a blocked governor, result in fly-wheel explosions. Strange to say, this is being done every day and sometimes with the full knowledge of the management. This practice cannot be condemned too severely, for while the engineer may be willing to risk his life and the manager may be willing to run the chances of a heavy property loss, they certainly have no right to jeopardize the lives of the employees and other persons who may be about the plant.

Blocking the safety attachment of a passenger elevator is another favorite pastime with some men, who do this rather than take the trouble of adjusting the governor to the proper speed limit. Imagine an elevator full of passengers with the safety attachment purposely put out of commission because it was found a little troublesome to adjust it—yet I have personally found cases of this kind, and in one instance was told by the man in charge that safeties as a rule did not work anyway in the event of accident. However, safeties do work, and the necessity of keeping safety attachments in proper working order can not be too strongly emphasized. It is true that no mechanical devise is absolutely reliable under all conditions, but thorough inspections and the proper care of safety attachments have in actual experience prevented many accidents.

It may not be amiss to say a few words regarding the engineer who depends entirely upon his subordinates. It is true that the responsible head of a large

*Extracts from a paper read at the 22d Annual Convention of the International Association of Factory Inspectors, held at Toronto, June 23 to 26.

†Superintendent Inspection Division, Maryland Casualty Co.

engineering plant cannot be expected and neither would he have the time to look after every detail, but as will be shown by the following experience, which is only one of many, a personal inspection now and then will often pay well. One of our inspectors visited an unusually large power plant for the purpose of inspecting boilers. Everything about the plant was apparently in the very best condition. At this plant special men are detailed to do nothing but look after the repairs, and the cleaning out of the boilers. The chief engineer pointed to one of the boilers, saying, "You may start on that one, but I hardly think it necessary to get inside, as I have just received a report from the man in charge, who reports everything in first-class condition," and on holding a light inside of the manhole the boiler certainly did look to be in excellent condition. However, the inspector, like the man from Missouri, "wanted to see," and it is well that he did. He first got into the manhole above the tubes. The tubes were found fairly clean, but a solid mass of scale was found on the back head between the tubes and the shell. This scale extended down to the lower row of tubes, the water space being solid with scale for a distance of one foot from the back head; also both sides were practically the same. In breaking out the scale we succeeded in getting a piece twelve inches long, three inches thick and six inches wide. An external examination showed that the shell plates at the points where the scale was found were very badly bulged and burnt. The rivets and the edge of the lap of the head seam were nearly gone. In order to put the boiler in safe condition, extensive repairs were necessary.

The old adage that "You can catch more flies with sugar than with vinegar" cannot be more forcibly illustrated than when making inspections. The inspector with the requisite amount of tact and diplomacy can say things the right way. He will succeed in having improvements made where the other man will make an utter failure. If, for example, there is anything that makes a manager or superintendent indignant, it is to have an inspector come around and criticise or find fault with certain dangerous conditions without being able to show in a clear, concise and practical way how the danger can be overcome. It may at times be advisable in order to emphasize the necessity of certain safeguards to refer to other plants, and if the inspector will use discretion there can be no harm in this. On the contrary, it will go a long way toward convincing the management that certain safeguards are necessary if he can show from actual experience that accidents have occurred due to the lack of them.

REPAIRS TO A 72-IN. REINFORCED-CONCRETE-JACKETED STEEL CONDUIT UNDER 30 FT. OF WATER.*

By A. W. CUDDEBACK,† Assoc. M. Am. Soc. C. E.

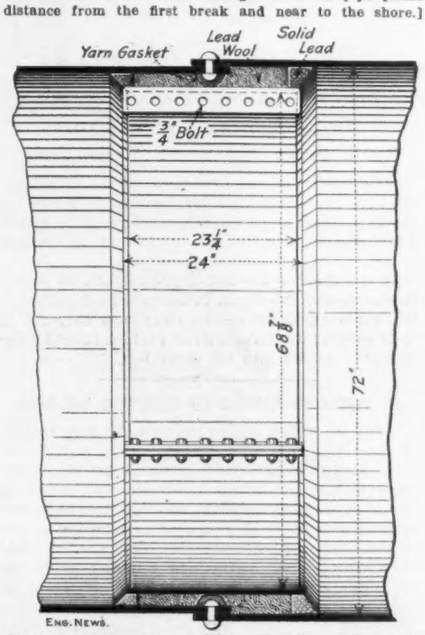
The pipe to which these repairs were made is a part of the plant of the Jersey City Water Supply Co., furnishing Jersey City, N. J., with water. This line is about 21 miles long, and runs from a large storage reservoir at Boonton, N. J., across country to Jersey City, and consists of concrete conduits, tunnel and steel pipe. The portion of this line in question under the Hackensack River was laid in 1902, and consists of 11/16-in. riveted steel pipe, 6 ft. in diameter. [See Eng. News, March 12, 1903.—Ed.]

The method employed in laying the pipe was as follows: The pipe was furnished on the ground in about 28-ft. lengths, made up of four sheets. These were connected upon the west bank of the Hackensack River on staging suitable for the purpose, carried out across the river and supported on floats. As the pipe was connected, it was enclosed in reinforced concrete rings, which were made in forms and slipped over the pipe and afterwards grouted, making eventually a continuous concrete covering. The weight of the pipe and concrete covering was just sufficient to sink it. After pipe composing the river crossing was completed and entirely supported by barges, it was lowered to its final position in a trench that had been prepared for it by dredging.

At the time the pipe was lowered into place and just as it was filled with water, a break occurred in a field joint at approximately the center of the river. This break was first noticed Dec. 15, 1902, shortly after the pipe was lowered into place and filled with water, and before the ends of the pipe were connected to the balance of the line. After discussing the possible character of the break and the method to be employed in repairing it, it was decided to build bulkheads in each end of the pipe, force the water out by air pressure, go in and make an examination. After considerable trouble the contractor who laid the pipe, and who was making the repairs, succeeded in getting the water out on about Jan. 10, 1903. It was then discovered that the pipe had opened up. In other words, a plate had parted about seven-eighths of the way around the pipe, the widest opening, 2½ ins., being on the bottom. It was repaired by putting a complete ring of steel plate inside the pipe over the break and fastening with stud bolts. The ring was put on in five pieces and the repairs finally completed about Feb. 16, 1903, two months after the break was first discovered.

No further trouble was experienced with this pipe until some time in 1904, when an examination of the river crossing developed the fact that there was a small leak. This was discovered by the sound which was plainly audible when passing over the pipe in the river in a boat. In November, 1904, a diver was employed to make an external examination of the pipe, but he could discover no evidence of a leak, except the noise. Shortly afterward it was observed that considerable water was being lost between Boonton and Jersey City. The measurement of the water flowing into the pipe was made through sluice gates at the intake at Boonton, and at Jersey City through a 72-in. Venturi meter. The noise at the river crossing made by the leak continued to increase, and the difference in the quantities, as measured at Boonton and Jersey City also increased, until the loss was between five and six million gallons daily.

In the fall of 1907, we again employed a diver to examine this pipe from the outside, and this examination, made Oct. 7, 1907, showed that there was a substantial stream of water coming out of the pipe [some distance from the first break and near to the shore.]



Method of Repairing a 72-in. Reinforced-Concrete-Jacketed Steel Water Main Beneath the Hackensack River, Jersey City Water Supply.

The diver reported that the stream coming from the pipe was of sufficient velocity and volume to force his body to one side when he passed in front of it, and that there was a hole in the concrete covering on the side of the pipe about 10 ins. square, and that the velocity was so great that he could not feel of the pipe to determine the character of the injury to the steel plates. The diver's description of the leak and the quantity of water being lost convinced us that we should make repairs at once.

It was at first decided that repairs might be made more economically without the aid of air pressure, and plans were made to get at the leak by pumping out the water. This pipe crossing in the Hackensack River is in the middle of the Hackensack Meadows, and about two miles from the nearest point that could be reached by wagon road, and at least two miles from the nearest point where power could be obtained. After considering the feasibility of getting electric power to operate the pumps, which would of necessity have to be placed inside the pipe in order to handle the water, it was decided that the cost of getting electric power would be excessive, and the difficulty of getting a steam plant there and handling the exhaust pipes within the main pipe led us to decide to abandon this method and make the repairs by means of compressed air.

A compressed air plant of sufficient capacity to handle the job, together with the necessary boiler power to operate it, was secured from the O'Rourke Construction Co. of New York, shipped to the river crossing by barge, and set up on the west bank of the river. At about 400 ft. west from the break a 48-in. tee had been placed in the line when it was built, with a main line 48-in. valve on either side of it, and a 48-in. valve on the tee; also a main line 48-in. valve on the east side of the river. This afforded means of getting into the pipe without cutting the main line. An air lock was obtained and fitted to the flange of the valve in the tee, the plant set up and got in working order. About 200 ft. east of the 48-in. branch which afforded a means of entering the pipe, and therefore 200 ft. nearer the river and the break, was a manhole. As soon as the pressure was off the main line, the cover was removed from this manhole, and another cover, which had been previously fitted with a 3-in. tapped opening through which a 3-in. nipple was screwed, was put on in its place. From this manhole we then connected a line of 3-in. screw wrought iron pipe, which had been previously prepared in suitable lengths and carried this 3-in. pipe down the 72-in. pipe toward the break, as the water was forced out of the 72-in. pipe through the break by the pressure of the air. This 3-in. pipe acted as a discharge for the water after the break had been stopped up and no more water could be forced out that way, and proved of sufficient capacity.

On Dec. 1, 1907, we made the first move towards getting into the pipe to determine the nature of the break. We shut down the main line valve on either side of the river, thus isolating the river crossing, which is about 1,000 ft. in length. These valves were finally closed at about 2 p. m. After these valves were closed the 48-in. valve on the branch was opened and as much water allowed to run out this section of pipe through the air lock as would do so. Then the air lock was closed and the air compressor was started. No difficulty was met in forcing out the water until it got to such a level in the pipe that the air would escape through the top of the break. As soon as this point was reached the air escaped with such rapidity that no further progress could be made towards forcing out the water. Several schemes were tried before we finally succeeded in plugging up the crack sufficiently to hold the air and force out the rest of the water. It being in the winter time it was exceedingly unpleasant to wade in water up to ones neck and by hand plug up the crack with clay. Large quantities of waste and gasket yarn were floated out on boards in the pipe and the crack partially plugged in this way, but this method was found to be slow and unsatisfactory. Finally the foreman in charge of the work waded out in the water in a diver's suit and succeeded in plugging up the crack with clay, after which there was no further difficulty in forcing out the water sufficiently to allow men to enter and examine the pipe thoroughly. It was discovered that the pipe had cracked about three-fifths of the way around, the crack being on top, and open at its widest part from ⅜ ft. to ½ in. This work took all Sunday afternoon, Dec. 1, all day Monday, the 2d, and up to 2.30 p. m. on the 3d, when we finally got down so we could make an examination and determine the nature of the rupture in the pipe. At this time we were notified by Jersey City that they were getting short of water, and that we would have to turn the water through this 72-in. pipe again in order to maintain their supply. The water was again sent through the pipe at 6 p. m., Dec. 3.

Owing to the difficulty of maintaining the supply to Jersey City without this 72-in. main being in service, and therefore the time for making repairs being limited to practically a 48-hour period, it was seen that it would be utterly impracticable to repair this break in the manner that the first break had been fixed. It had been our intention before examining the break to make repairs as before, i. e., to rivet on patches with stud bolts, but we now decided that this could not be done without delay and that repairs must be made in the shortest possible time, and the question was, how repairs could be made so that they might be completed in the least possible time. After considerable discussion of various plans proposed, it was decided to put an internal ring in the pipe, and our first thought was to make this ring of cast iron. After considering the subject in all its phases, especially the difficulty of handling the heavy weight of iron that would be necessary, it was finally decided to make the internal sleeve of steel plate. This sleeve was made up of three steel plates, 2 ft. wide × 6 ft. long, as shown by the accompanying section. It was thought that these plates could be bent to form an angle for bolting together, but it was discovered that this could not be done without cracking the plates, and angles were riveted to the plates to form flanges. Set screws were put in the plates to assist in adjusting and holding the sleeve in position in the pipe.

Several materials were considered as filling between the sleeve and the pipe. Pyrocenit was one of these; this is a patent cement which will expand upon setting. This cement was rejected as a filling because of the time necessary for its setting, which in that position would have been at least 24 hours before it would have been safe to let water come in contact with it. Lead, in its usual form, was rejected because of the impracticability of pouring the joint completely, and the fact that even if it were possible to pour it, it could not be caulked its entire depth. Lead wool was finally decided upon as the material to be used in filling the joint. This was selected on account of the facility with which it could be handled, the fact that it could be placed in

*Slightly condensed from a paper read before the American Water-Works Association, Washington, D. C., May, 1908.

†Engineer and Superintendent Passaic Water Co., Paterson, N. J.

the pressure of water, and that it could be calked in the entire depth of the joint.

After the first examination of the pipe was made, the actual starting or repairs was delayed for several days until arrangement to supply Jersey City with water while the conduit was out of service were made, and the repairs proper were begun on Dec. 19, 1907. The water was turned off at 8.45 a. m. on this date, and the pipe finally emptied below the position of the break, the necessary tools, sleeve, materials, etc., gotten in the pipe by 6 p. m. During the night the sleeve was placed in position ready for the filling material.

After the sleeve was placed in position, the center of the joint around the row of circumferential rivets of the pipe, where the crack was located, was thoroughly calked with ordinary gasket yarn smeared with clay, in order to prevent the water working in and getting in around the layers of lead wool which were to follow, and to act as backing for the first layer of lead. Then the filling was continued from either side with lead wool and thoroughly calked to within about 2 ins. of the outside edge of the sleeve. This outside space was filled with strips of solid lead, 3 or 4 ft. long, which had been poured in moulds the thickness of the joint, thoroughly calked, and leaving the sleeve finished in position as shown. The work of calking in the lead wool was begun at 6 a. m., Dec. 20, and carried on continuously until finished, and the water again turned on about 7 p. m. of the same day, making the total time that the conduit was out of service approximately 36 hours. The pipe was tested for leakage when the water was turned on and found to be tight.

Special homemade calking tools were used in placing the lead wool in the joint. The men who actually made the repairs worked in two shifts of five men and foreman for each; two hours in and two hours out of the conduit, the same men working in this way from start to finish of the job. The men were all from the regular working force of the company, and were selected for their known qualities of endurance, and to their faithfulness is due very largely the successful completion of the job in so short a time.

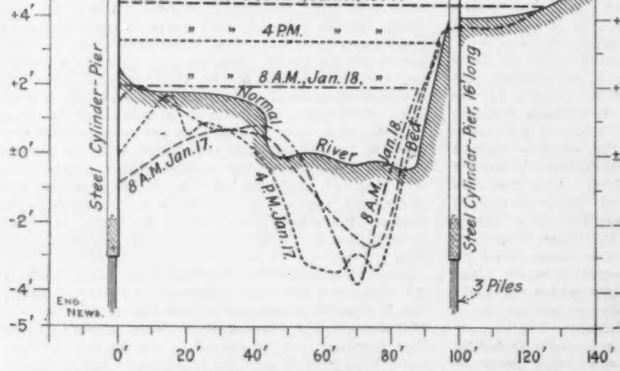
To Chris McGarry, the general foreman in charge of the work, great credit is due for the careful and complete manner in which he carried out the plans, and provided for all emergencies likely to arise in such an undertaking.

Acknowledgment is hereby made of the assistance and advice given in planning and carrying out this work to John H. Cook, Hydraulic Engineer of the Company; Edlow Harrison, Chief Engineer of the Company; J. Waldo Smith, Consulting Engineer, and Fred Gubelman, of the O'Rourke Construction Co., of New York.

AN INSTANCE OF RIVER SCOURING AT TUCSON, ARIZONA.

By G. E. P. SMITH,* Assoc. M. Am. Soc. C. E.

The results of a study in the scouring of the Santa Cruz River at Tucson, Ariz., as shown by the accompanying figure, may be of interest as an indicator of the proper depth for bridge piers, canal inverts, etc. The figure shows a cross section of the Santa Cruz River, at this place,



CROSS-SECTION OF THE SANTA CRUZ RIVER AT TUCSON, ARIZONA.

and gaging measurements during a flood. The corresponding discharges are as follows:

8 a. m., Jan. 17	4,100	second-feet.
4 p. m., Jan 17	3,300	"
8 a. m., Jan 18	925	"

*Irrigation Engineer of the Agricultural Experiment Station, Tucson, Ariz.

This flood rose overnight, the flow the previous evening having been but 15 sec.-ft. It is evident that the cutting continued after the flood had commenced to recede. Since the flood waters in western rivers are very muddy it is impossible to estimate the depth from a previous knowledge of the river bed. The rancher or traveler often drives into such rivers quite confidently, but soon has to swim his horses to safety. Thus many disasters ascribed to quicksand should properly be attributed to scoured holes.

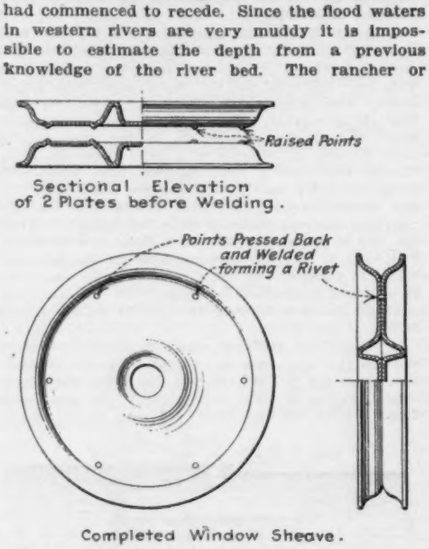

Raised Points
Sectional Elevation of 2 Plates before Welding.
Points Pressed Back and Welded forming a Rivet
Completed Window Sheave.

Fig. 1. Details of Weld of a Window Sheave.

At the time of the last measurement, as shown in the figure, the depth of scour was 4 ft., while the apparent depth of the river was only 2.5 ft. It is evident that the cylinder piers should have extended deeper into the river bed.

AN IMPROVED METHOD OF ELECTRIC WELDING.

A process which makes possible the substitution of steel for malleable iron in many articles of light hardware has been invented by Mr. Lawrence S. Lachman, and in conjunction with the Thomson electric welding machine has been developed to a point of practical commercial utility by the Universal Electric Welding Co., of New York City. The method is founded primarily upon the idea that as two pieces of metal of unequal section do not unite readily to form a good weld, two points, or a point and a ridge must be raised on the pieces to be united. These raised contacts are forced together under hydraulic pressure and, forming the link of lowest conductivity in an electric circuit, are heated by the current to a temperature at or near fusion; the two projections are thus quickly united and form a bond or rivet which is even stronger than an ordinary rivet, because it is one piece with the body of the metal.

An illustration of the practical application of this process is the manufacture of light steel pulleys for window frames. The two halves of the pulley are stamped from sheet metal, and in the stamping, as shown in Fig. 1, projecting joints are raised on the faces which are to be in contact. The two halves to form a pulley are then placed in an electric welding machine and forced together at the same time that the welding current is applied. The machine shown in Fig. 2 turns out these pulleys at the rate of 40 a minute.

Pieces to be united may possess any form, attention being paid to accurate and secure clamping during the manipulation. The temperature to which the metal is raised can be controlled either automatically or by hand. No difficulty is experienced when using parts of widely differing thickness or other dimension, or of different metals; the union of brass, copper or even zinc to iron is accomplished in the manufacture of various commercial appliances; a spade of unusual strength is made by joining a shank of Bessemer steel to a plate of locomotive-tire steel.

Fig. 2. Universal Electric Welding Company's Welding Machine.
Arranged to Unite the Two Plates of a 4-in. Window Sheave.

The speed attainable by this process is well instanced in the results accomplished in the manufacture of bath tubs; formerly it was a day's work for four men to join the feet to the bottoms of 80 tubs. In the shops of the Universal Electric Welding Co., at Lynn, Mass., two men now turn out 250 tubs per day. One man assembles 380 12-toothed steel garden rakes a day—the former production of a whole shop, as it was then necessary to put the same rake into the fire 22 times. By the present system, the cold rolled teeth are simply pressed into place under the action of the electric current. At present the process is being applied to the manufacture of small farm implements, cooking utensils, letter-boxes and various light articles which formerly required careful and tedious riveting. Experiments are being carried on in the manufacture of heavier articles.

THE HUMAN SIDE OF A MINING ENGINEER'S WORK.*

The special work of the engineer is to apply the discoveries and methods of science to the practical business of the world. Often he forgets how many-sided a man must be for this end, and then, enthusiastic and absorbed in technical details, he overlooks the fundamental requirements of life. I urge you, therefore, not to forget that the world is made up of things and of folks and that nine-tenths of your life is going to be with folks.

The enthusiasm kindled in a student's heart by contact with the scientific spirit is and must always be the inspiration of the mining engineer, but his own life work is most sternly practical. It is the production of wealth from the forces and materials of nature. It leads out of the library and the laboratory, and into the busy world of men and affairs. Year by year it calls more and more, not for the intense and narrow specialist, but for many-sided ability, for the well balanced man. The practical business of an engineer seldom requires profound technical knowledge, but it does demand a working knowledge of men and skill in dealing with them. He can often prosper without the former, but

*Extract from an address before the graduating class of the School of Mines and Metallurgy, University of Missouri, Rolla, Mo., June 10, 1908, by Edmund B. Kirby, Manager Federal Lead Co., Flat River, Mo.

without the latter his chances are small. The special word I bring you today, therefore, is to seek for success among human beings and throw off the personal defects which handicap you in the world of men and women.

The business world is not interested in the details of your education. It is generally understood that the completion of a course like yours indicates that the man has made good in his first test, that he has carried through successfully his first serious undertaking. This gives promise for the future, and the fact of technical training assures ease in breaking a new man into the business. But you do not yet know that the questions an employer asks are merely these: Has he good sense above the average? What is his personal bearing and address?

You will find that a diploma is of little interest to others, but a likeable personality is a passport, good for life in all countries. In time you are to discover that tact and diplomacy solve more problems than engineering formulae. That a memory for names and faces will help you more than one for minerals and rocks. Sooner or later you will know that good sense, that ability to decide which of any two things is the more important, is an asset beyond price. You will awake to the fact that valuable as is skill in the higher mathematics, it will never push you to the front like the ability to write a letter which will really do its work. How will you deal with people if not through language, that means by which your thoughts and will may reach the consciousness of others; that delicate and subtle medium necessary for the most simple affairs of daily life, yet capable under a master's touch of swaying a multitude, of moving the world? How far have you learned its use? You have studied the reactions of chemistry, but how much have you learned of those subtle human reactions which break down indifference and create friendship?

But you say this wanders from engineering matters. These are the winning qualities for all men. I answer "Quite so, the successful mining engineer is the successful man."

The technical side of a mining engineer's work is and must remain its distinctive feature. Next to the fundamental requirements of life its importance is conceded by all. Not only is it necessary for him to shape his social qualities and general attainments upon broad-gage lines, but it is well to recogdize that the technical knowledge demanded by the mining world is broadening. The single specialist of former days is now under a disadvantage.

There are men who shut themselves up, and out of their inner consciousness evolve some great work, such as an invention, or a book. Occasionally, also, men go into the wilderness and discover a mine. But such individual play is rare and its chances are small. The real business of the world is done by team-work, and you must qualify for this. It is done by innumerable bodies of men, each of which is under some kind of organization, intended to combine its units into an efficient human machine, capable of the business on hand. Now, every such machine, whether it be a baseball nine, a section gang, the force of a great steel plant, a railway system, or an army, works more or less badly. The individuals who compose it, from the general to the private, from the business head to the lowest employee have human weaknesses which are much alike, and the results are friction, loose joints, lost motion and sand in the gears. Nevertheless, the outfit goes creaking along, and usually gets there, often to its own surprise.

There are weak points in abundance, not only on the human, but also on the technical side of every business. There is a best way to do each operation, from the handling of a shovel, up, and it is not always done in this best way. Moreover, methods, processes and machines are constantly changing, constantly advancing. These two conditions, the imperfections of technical methods, and the faults of human organization, will provide your openings. It is because of them that the world is so full of opportunities for men who have the combination of sound techincal training and good sense.

When, therefore, you hold a job, do not waste time in complaints and fault-finding. You will continually see waste and loss; things which are wrong, things which need improvement. Others see them, too. If you have sense you will notice everything, but will keep your mouth shut. Some day your chance will come. Your advice will be asked. Some day you will be given charge or a small piece of work, of a few men, and may then bring out your ideas by doing this work better and more cheaply than the man before you.

An able man will move up from any job and there are no rules for fortune. But in your profession the chances are generally somewhat better for those who are able to start as workmen, or in positions close to the working force. If the machine of which you are a part is too bad, get out, but while you are in any business organization, be loyal to it, hold up the hands of those above you, and keep your own work as free as possible from the faults you notice elsewhere.

It may sometime be of service to know that to be fired from a job is often the best thing that can happen to a man, if he is really built of the right stuff. It galvanizes him into life, jerks him out of a rut, tests his own resources and makes him start fresh in new surroundings and with new people.

Throughout your career you will make errors and have occasional bad falls. Avoid the delusion that such occurrences are fatal. No error is serious, unless you fail to learn its lesson, or allow it to weaken your courage. Some of the most successful men I have known had failed so many times that they stopped remembering. Because they stopped, they succeeded. If by the caprice of fortune, any of you should eventually meet with disappointment, if you should fail to realize your hopes and ambitions, you will by that time have learned that your only failure has been to escape the common lot of many. You will by that time understand the Arizona epitaph, "Life ain't in holding a good hand, but in playing a poor one well."

Under normal conditions your status will long be simply that of the human animal, struggling for the existence of self and family, differing from other animals only in the complexity of itself, its environment and its struggles. This struggle for existence is your first duty, and may long demand your whole attention. But for those of you who respond to the spirit of the age, the time should come, by middle life if at all, when your eyes will be lifted from the details of self seeking. you will suddenly become conscious of the great human organism of which you are a part and of your relations to it. You will have attained intelligence. Thenceforth a part of the awakening soul of humanity, you will see through the surface and into the injustice and unhappiness of the world around you. When this awakening comes, with the new duties it imposes upon your conscience, follow them. Choose what line of action you please, but do something. You may elect either to pick up wounded, or to get into the fighting line somewhere, but get busy. Join those who are trying to make the world a decent place to live in.

SPREADING RAILS caused the wreck of a northbound passenger train on the St. Louis & San Francisco R. R., near Hugo, Okla., July 26. The locomotive and three of the cars left the track and were overturned, and three men were killed.

AN ELEVATED EXPRESS TRAIN of the Ninth Avenue line in New York City crashed into the rear of a local train at 86th St. and Columbus Ave., July 29. The guard on the rear car of the local was seriously injured. The local had stopped, according to the statement made by the railway company, to wait for another train to pull out of the station, and the express ran at high speed against the rear car. The rear platform of this car was demolished and the roof splintered nearly to the middle of the car, while the body of the first car on the express train was forced from the trucks. Although the passengers were obliged to walk some distance along the track to the station, no one was injured by contact with the third rail.

A NEW RAILWAY IN BOLIVIA was completed Aug. 1, connecting the cities of Oruro and La Paz. This road, 125 miles in length, connects with the Peruvian Southern which runs south to Antofogasta, a Pacific port in Chile. It was constructed by American contractors, and the National City Bank and Speyer and Co., of New York, are interested in the financial side of the undertaking.

A COAL TRAIN was wrecked on the Philadelphia & Reading Ry., Aug. 2, near Meadow Brook, a suburb of Philadelphia. The train was made up of 27 steel cars and one wooden car, and said to be running at the rate of 50 mi. per hr., when a wheel flange broke on the wooden car. This car left the rails, and, being near the front of the train, dragged the others after it. Nineteen of the 28 cars were wrecked and the tracks were torn up for a distance of 400 ft. Traffic was delayed for ten hours.

THE GOLDEN STATE LIMITED of the Chicago, Rock Island & Pacific Ry., westbound, was wrecked Aug. 3. The accident occurred 40 miles east of Benson, Ariz., on the Southern Pacific line, over which the Rock Island trains run to the coast from El Paso, Tex., and was caused by the breaking of a rail. Two sleepers and the observation car were turned over and the dining car derailed. Eight persons were injured. The failure of the rail is ascribed to an interior defect which could not be detected by inspection. The track at this point was protected by automatic electric signal, but since the break occurred under the train no advance warning was given.

THE CALIFORNIA LIMITED, of the Atchison, Topeka Santa Fe Ry. was wrecked at Wakarusa, Kan., 15 miles south of Topeka, at noon, July 30. The train was running at 50 mi. per hour, its regular speed through Wakarusa, when the tender jumped the track. After leaving the rails it ran along the ties for 800 ft., when it struck a switch and was led away to the side, jerking the locomotive around at right angles to the track. The mail car, baggage composite, diner and the first sleeping car were piled in a heap against the locomotive. The engineer was killed, and 20 persons were injured.

THE PHILADELPHIA SUBWAY was opened for inspection on July 30, and the first train was run through on August 3. This addition to the transit facilities of the city is a continuation of the elevated railway, which extends out Market St. from the Schuylkill River to 69th St. (Engineering News, December 29, 1904, p. 584). The subway takes up the line at the Schuylkill and extends eastward down Market St. around the City Hall to the Delaware River, a total distance of about two miles. On account of the short distance, only local traffic is provided for, to be carried on two tracks.

THE CAVING-IN OF A COAL MINE at Crow's Nest Pass, B. C., July 31, entombed 23 of the miners. It will be necessary to tunnel through 400 ft. of earth to reach the buried men. Crow's Nest Pass is within the region swept by the extensive forest fire of Aug. 1, which may interfere with the work of rescue.

AN EXTENSIVE CONFLAGRATION IN CHICAGO, said to be the most destructive since the great fire of 1871, burned over an area of six city blocks in the elevator and freight warehouse district Aug. 3. Eight men are reported dead in the ruins. The fire started in the outbound freight house of the Chicago, Burlington & Quincy R. R. Co., which fronts on the west side of the Chicago River. This building was of wooden construction and contained, besides other merchandise, a number of barrels of chemicals and oil. Some of these exploded soon after the fire started and caused a rapid spread of the flames. Among the buildings destroyed were Armour & Co.'s grain elevators "E" and "F" and a large elevator belonging to the Union Elevator Co. They contained 1,875,000 bushels of wheat. More than 500 freight cars, many of which were loaded, were destroyed in the Burlington yards. The steel fireboat "Illinois" was caught by a falling wall, Aug. 4, near 16th St., and sank immediately.

A FOREST FIRE in the East Kootenay District, B. C., destroyed an immense tract of forest growth and 25,000,000 ft. of cut timber and lumber. It is estimated that at least 100 lives were lost in the flames. The fire first became dangerous Aug. 1, and at last reports (Aug. 4) is still burning. Under the influence of a strong wind, it swept along the line of the Canadian Pacific Ry. from the town of Fernie to Crow's Nest Pass, a distance of about 70 miles. Its path is said to have varied in width from one to three miles. Fernie was entirely destroyed, and the towns of Hosmer and Michel were partially burned. The 5,000 inhabitants of Fernie were obliged to seek safety in flight and are left homeless. Among the buildings reported as destroyed at Fernie was the reinforced-concrete mill of the Elk River Lumber Co., which had been considered to be fireproof. Apart from the lumber companies, the Canadian Pacific Ry. bore the heaviest loss, suffering the destruction of their buildings and coal bunkers and 100 cars at Fernie, in addition to the extensive damage to tracks and bridges.

THE CHINESE TYPHOON of July 28 swept over Hong Kong Harbor with great destruction of life and property. Four foreign war vessels were disabled, and two large British steamers were blown ashore, while hundreds of native craft were wrecked and several hundred people drowned. Buildings were blown down in the towns along the coast for several hundred miles. The granite building in which were the offices of the Pacific Mail Steamship Co. was among those destroyed.

THE FIRST SKELETON SKYSCRAPER in New York is soon to be razed to make way for a much higher structure. The old building, known as the Tower Building, located on lower Broadway, was built in 1888 on a very narrow lot, so narrow that the architect had to adopt the then novel cast-iron column and wrought-iron girder construction in order to have any floor space at all in the lower of its eleven stories. The new building, which is to cover the site of the Tower Building and several other adjoining lots, is to be 38 stories high, second only to the Singer Tower in lower New York. Mr. Bradford L. Gilbert was architect of the original Tower Building.

THE DEVELOPMENT OF THE HARBOR of Washington, D. C., has recently been made the subject of an exhaustive report by a special committee, composed of the harbor master, the engineer of bridges and the chief clerk of the engineer department of the city, these three officers representing, respectively, the commercial, the engineering and the legal phases of the question. The report has been printed as a public document and submitted to Congress for its future action. The available water frontage of the District of Columbia was found to be about 18 miles, of which eight miles have been withdrawn from commercial and public use by the United States for its own use. At

present only two miles are used for commercial purposes, but according to the new scheme eight miles can be made available by a proper development. The plan for improvement covers a good many years of the future, and would cost nearly $3,000,000 to fulfil. It contemplates the purchase and the control for future rental to private interests of that portion of the waterfront not already governmentally owned, the deepening of the northerly or Washington channel and the construction of wharves and port facilities therein, the improvement of the southerly or Georgetown channel, the improvement of the Anacostia River in both channel and banks, and, finally, the improvement of the eastern bank of the Potomac below the Anacostia to the District line. The report contains full estimates and many designs of channels, harbors and wharf and dock structures.

HENRY FARMAN, the aeronaut recently made famous by the performance of his acroplane, has been making short exhibition flights of up to 800 yds. at the Brighton Beach race track, near New York City, since July 31 and will continue to do so until Aug. 15.

The Zeppelin dirigible balloon, on Aug. 4, started on its much heralded 24-hr. flight, from Friedrichshafen, on Lake Constance, Germany. After flying 261 miles to Mayence over two legs of the triangular course it was necessary to descend for repairs to the driving mechanism. After a stop of about four hours, the dirigible again ascended and started on the return course to Friedrichshafen. After going some 50 miles further, it was necessary to descend and summon mechanics to complete repairs. These descents spoiled the 24-hr. flight, of course, but the trip to Mayence gives Count Zeppelin the distance record for flight in a dirigible balloon. The huge air craft carried 12 persons in all.

Preliminary tests of the dirigible balloon made by Capt. T. S. Baldwin for the signal corps of the United States army, were held Aug. 4 and 5 at Fort Meyer, Va., previous to the official trials. Complete control of the movements was obtained.

PANAMA CANAL EXCAVATION during the month of July totaled 3,168,840 cu. yds. in the 26 working days, a daily average of 121,494 cu. yds., as against the June total of 3,056,976 cu. yds., or a daily average of 117,576 cu. yds. for the 26 working days. The rainfall in July was 11.14 ins. and in June 9.99 ins. On account of the changes recently made in the organization of the various divisions of the canal work, it is impossible to give comparative figures by divisions, as has been our custom for the past year. The itemized excavation for July in cubic yards place measurement is as follows:

Steam Shovels—	
Atlantic division	160,331
Central division	1,441,119
Pacific division	122,839
Dredging—	
Atlantic division	625,497
Pacific division	696,170
	3,045,956
Accessory works outside canal prism by steam shovels	122,884
Total excavation	3,168,840

EXTENSIVE GRADE-CROSSING REVISION is to be begun in the near future in the city of Baltimore, principally upon the right-of-way of the Baltimore & Ohio R. R., at South Baltimore. Plans are now in preparation for the work which is estimated to cost about $12,000,000 and to cover some five years in the execution.

IN THE FERRO-BORON COMPETITION, instituted by the Pacific Coast Borax Co., 100 William St., New York City, through the American Electrochemical Society, governing regulations have been drawn up by a committee of the society. Five Hundred dollars has been deposited in trust as a research fund, to be awarded as a prize for a commercial method of manufacturing ferro-boron alloy direct from colemanite. It is essential that the process be economical and applicable on a large scale.

Commercial ferro-boron, as now made, contains 20% of boron, less than 3% of carbon, with sulphur and phosphorus practically absent. The following conditions of the contest have been imposed:

(1) The treatise on the subject must be in typewritten form and accompanied by a sample produced by the process described in same. (2) The competition for the prize is open to any one and is not restricted to members of this society. The treatise on the subject must be enclosed in a plain, sealed envelope, not bearing the author's name, but identified by a pseudonym. The outside of the envelope, containing the paper, must be labeled with the pseudonym and with it should be sent another plain sealed envelope, also labeled with the same pseudonym, which should contain inside the envelope the name and address of the competitor. Both these envelopes should be sent to Prof. Morris Loeb, 273 Madison Avenue, New York City.

(3) All papers competing for the prize must be in the hands of Prof. Loeb before October 1, 1909. Prof. Loeb shall retain the small sealed envelope, containing the address of the competitor, and forward the large envelope to the Secretary of the American Electrochemical Society, to be submitted to the Board of directors, who will award the prize. In this manner, as the treatise must be typewritten, the Board can act with entire impartiality, and the paper shall be judged on its own merits, so that the author's standing can have no influence whatever on the decision. The competitors for the prize forfeit none of their property rights in the process submitted.

(4) As soon as the Board of Directors has agreed upon the best treatise it will request from Prof. Loeb the address of the author thereof, who will then be required to demonstrate his process before the prize will be finally awarded.

(5) The Pacific Coast Borax Co. has offered to supply anyone who desires to compete for the prize seriously with all the crude colemanite that the parties making the experiment may require, provided that the request for this colemanite be accompanied by a letter signed by one member of the Board of Directors of the American Electrochemical Society, endorsing the application for the material. This condition is merely made so as to furnish the material only to those who may have the proper qualifications to experiment intelligently and with some chance of success.

PERSONALS.

Mr. A. H. Julian has been appointed to succeed Mr. Joseph McInnis as Superintendent of Sewers of San Diego, Cal.

Col. Thomas W. Symons, Corps of Engineers, and Col. Richard L. Hoxie, Corps of Engineers, have retired from active service.

Mr. D. O. Ives, General Traffic Manager of the Wabash R. R., left that position August 1 to become chairman of the Official Classification Committee, New York City.

Mr. J. R. Dillon, Superintendent of the Houston Belt & Terminal Ry., has been appointed Vice-President and General Manager of the Gulf & Interstate Ry. of Texas.

Mr. George Wagstaff, Supervisor of Boilers for the New York Central lines, has resigned that position and will enter the service of the Railway Materials Co., of Chicago.

Mr. T. Brooke White, an Assistant Engineer of the U. S. Reclamation Service, has been transferred from the Washington office to the office of the Supervising Engineer, Portland, Ore.

Mr. Eugene W. Stern, M. Am. Soc. C. E., and Mr. Samuel C. Weiskopf, M. Am. Soc. C. E., have dissolved partnership, and will continue their practice as consulting engineers separately.

Mr. R. J. Newell, an Assistant Engineer of the Idaho Division of the U. S. Reclamation Service, resigned that position, July 15, to take a position with the Great Shoshone & Twin Falls Water Power Co.

Mr. Oliver Snyder, Superintendent of the southern and Galveston divisions of the Gulf, Colorado & Santa Fe Ry., will be transferred to the northern division. Mr. A. P. Hall, who is now in charge of the northern division, will be transferred to the Galveston division, and Mr. K. S. Hull, Supt. of the Texas & Gulf Ry., will take charge of the southern division. This change goes into effect Aug. 15.

Obituary.

James J. Phelan, Commissioner of Docks of New York City in 1894 and 1895, under Mayors Gilroy and Strong, died Aug. 3 at Allenhurst, N. J., after a long illness from cancer. Mr. Phelan was born in New York about 61 years ago, and was educated at St. Francis Xavier College. He was for many years Secretary and Treasurer of the American Contracting & Dredging Co.

Arthur S. Farwell, a Canadian surveyor, was found dead in his bed in his home in Nelson, B. C., July 29. Mr. Farwell located the town of Farwell, now the city of Revelstoke, B. C., and surveyed large portions of the Kootenay districts. In the early eighties he acted for the government and the Canadian Pacific Ry. in locating the line of that road through Eagle and Rogers passes in the Rockies.

Captain David Z. Brickell, former Vice-President of the Chambers & McKee Glass Co., of Pittsburg, Pa., died in that city, July 29, at the age of 83 years. Captain Brickell was in charge of the transport steamer "Florence" during the Civil War. Since the war he has been successively part owner of the Kittaning Rolling Mills, Superintendent of the Castle Shannon Coal Yard, and President of the Southside Ry. Co. He became a member of the Chambers & McKee Glass Co. in 1891. His only son, William D. Brickell, of Columbus, was present at his death.

James Duncan Hague, M. Am. Inst. M. E., died at his summer home in Stockbridge, Mass., Aug. 4, of heart disease. He was born at Boston in 1836, the son of William Hague, a Baptist clergyman. His early education was obtained in the Boston public schools, and he afterward successively attended the Lawrence Scientific School at Harvard; Georgia Augusta University, Göttingen, Germany, and the Royal School of Mines, Freiberg, Saxony. He completed his studies in the last-named institution in 1858.

In the two following years he was engaged in an exploration of the South Seas, and in 1862-3 he served for a short period in the U. S. Navy. He b[illegible]e the manager of some of the Lake Superior copp[illegible]nes in 1865 and participated in the early development [illegible] the Calumet & Hecla mine. In 1867 he became First [illegible]ssistant Geologist of the U. S. Geological Survey of th[illegible]th parallel and later spent several years in an exami[illegible]on of mines and mineral resources in Nevada and C[illegible]rado, and in the preparation of an elaborate report [illegible] the survey, which was published in 1870 under the t[illegible] of "Mining Industry." From 1871 to '78, he reside[illegible] California as a consulting mining engineer. In 18[illegible] he went to the Paris Exposition as a U. S. Commissio[illegible]. Afterwards he published a book, entitled "Mining In[illegible]stries of the Paris Exposition." Since 1879, Mr. H[illegible] has made his headquarters in New York City, and [illegible]s been connected with a number of mining enterpri[illegible]. His wife, formerly Mary Ward Foote, of Guilford, [illegible]n., died in 1898, leaving two daughters and a son. [illegible] Hague was a member of the New York Chamber of [illegible]ommerce, the American Museum of Natural History, th[illegible] Metropolitan Museum of Art, the American Geographic[illegible] Society, and of a number of prominent New York clu[illegible].

ENGINEERING SOCIETIES.

COMING MEETINGS.

THE TRAVELING ENGINEERS' ASSOCIATION.
Aug. 25. Annual convention at Detroit, Mich. Secy., W. O. Thompson, New York Central Shops, East Buffalo, N. Y.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 23-25. Annual convention at Atlantic City, N. J. Secy., Willard Kent, 715 Tremont Temple, Boston, Mass.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Sept. 29. Annual meeting at Birmingham, Ala. Secy., R. W. Raymond, 29 West 39th St., New York City.

LEAGUE OF AMERICAN MUNICIPALITIES.
Sept. 30-Oct. 2. Annual convention at Omaha, Neb. Secy., John MacVicar, Des Moines, Iowa.

ILLUMINATING ENGINEERING SOCIETY.
Oct. 6-7. Annual convention at Philadelphia, Pa. Secy., Van Rensselaer Lansingh, Engineering Societies' Building, 33 West 39th St., New York City.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.
Oct. 12-16. Annual convention at Atlantic City, N. J. Secy., B. V. Swenson, 29 West 39th St., New York City.

RAILWAY SIGNAL ASSOCIATION.
Oct. 13-15. Annual meeting at Washington, D. C. Secy., C. C. Rosenberg, 12 North Linden St., Bethlehem, Pa.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.
Oct. 20-22. Annual convention at Washington, D. C. Secy., R. H. Reid, Lake Shore & Mich. Southern Ry., Cleveland, Ohio.

AMERICAN ELECTROCHEMICAL SOCIETY.
Oct. 30-31. Fall meeting at New York City. Secy., Dr. J. W. Richards, Bethlehem, Pa.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION.—Secy., A. P. Dane, B. & M. R. R., Reading, Mass. The 39th annual convention will be held Sept. 8-11 at Atlantic City, N. J. Among the subjects to be treated are the following: The Painting of Steel Cars; Substitutes for Turpentine; Fire Precautions in Railway Paint Shops.

THE INSTITUTION OF MUNICIPAL ENGINEERS.—At a meeting of the executive committee of this new society held in London, England, July 8, a committee was formed to draft by-laws for the institution. It is proposed to inaugurate a system of examinations of a severely practical character, for which certificates will be granted, in the chief branches of professional work. These examinations will be subsequent, and not precedent, to admission to membership, and will be conducted for the satisfaction of those members who may desire to have their special knowledge of some branch of municipal engineering tested. The carrying out of practical work is the only qualification for admission to the Institution. A committee was also formed at this meeting to consider the question of the publication of a quarterly journal for circulation among the members. Thirty-six new members were admitted. The Institution has already a membership of over two hundred.

AMERICAN ELECTROCHEMICAL SOCIETY.—A new class of members has been provided, as shown in the following amendment to the constitution, adopted at the last meeting of the Board of Directors:

Students in High Schools, Technical Schools, Colleges or Universities, or assistants in technical laboratories, furnishing references of good character from their professors or employers, subject to the approval of the Board of Directors, may, by the payment of the annual dues, without entrance fee, become affiliated with the American Electrochemical Society as "Junior Associates." They will be printed as such on the roll of the society, will receive the Transactions, monthly bulletin and other notices of the society, may attend meetings, offer papers, take part in discussions of papers, and participate in visits and social functions; but they do not have the right to hold office, vote for officers, or to vote on or discuss business motions brought before the society. Said "Junior Associates" may remain as such not over five years from their first enrollment, and may become members at any time by being regularly elected by the Board of Directors and paying the entrance fee.

CONSTRUCTION NEWS

Supplement to ENGINEERING NEWS. New York, August 6, 1908.

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CONSTRUCTION NEWS.

PLANS AND SPECIFICATIONS ON FILE.

(denotes that this work is advertised in Engineering News.)*

The following Plans (P.) and Specifications (S.) are on file and may be seen at the office of The Engineering News Publishing Co., 220 Broadway, New York.

Bids close.	Work.	Place.	See issue.
8-14	*Reservoir,	Lincoln, Neb..(P. & S.)	7-30
8-11	*Sidewalks,	Saranac Lake, N. Y. .....(S.)	8- 6
8-15	Boilers,	Philadelphia, Pa.....(S.)	7-30
8-19	*Pumping plant, equipment,	Jerseyville, Ill. .....(P. & S.)	7-23
8-20	*Garbage removal,	Youngstown, O. .....(P. & S.)	8- 6
8-26	*Revetment, etc.,	Milwaukee, Wis. .....(S.)	7-30
8-27	Dam, etc.,	Orland, Cal.....(S.)	6-11

LIST OF CONTRACTS PENDING.

LIGHT, HEAT AND POWER PLANTS.

8- 7 Power plant, Hartford, Wis..... 7-30
8-10 Electrical supplies, etc., Panama.. 8- 6
8-12 Lighting, Delmar, N. Y..... 8- 6
8-15 Conduit, Takoma, D. C..... 8- 6
8-24 Light plant, New Bremen, Ohio.. 8- 6
8-25 *Power-house equipment, etc., Port Washington, Wis..... 7-30
8-26 *Power-houses, Wheeling, W. Va.. 7-30
8-31 Power-house, Wheeling, W. Va.. 8- 6
9-14 Lighting streets, Hartford, Conn. 7-30
9-15 Elec. light plant, Winnipeg, Man. 7-30

BRIDGES.

8- 7 Bridge, North Vancouver, B. C.... 7-30
8- 8 Bridge, Cleveland, Ohio..... 7-23
8- 8*Bridge, Aurora, Ill. 7-30
8- 8 Bridge, Crawfordsville, Ind 8- 6
8-10 Culvert, Chicago, Ill..... 8- 6
8-10 Superstricture, Jefferson, Ohio.... 7-23
8-10 Bridges, Newport, Ind..... 7-30
8-12 Bridge, San Antonio, Tex..... 7-30
8-12 Bridge, St. Joseph, Mich..... 7-23
8-12*Bridge, Rye, N. Y. 7-30
8-12 Bridge, Allentown, Pa..... 8- 6
8-13*Substructure, etc., Douglas, Ga.. 7-23
8-13 Bridge extension, Hobart, Okla.. 7-30
8-17 Bridges, Linton, N. Dak..... 8- 6
8-17 Bridge, Lakewood, Ohio 8- 6
8-17 Bridge, Springfield, Ohio 8- 6
8-18 Bridge, etc., Plattsmouth, Neb... 8- 6
8-18*Bridge, Salisbury, Md. 7-30
8-19 Bridge work, etc., Cleveland, O.. 7-30
8-20 *Viaduct, Atlanta, Ga..... 8- 6
8-21*Bridge, Woonsocket, R. I..... 8- 6
8-22*Bridge, Rocky River, Ohio..... 7-23
8-24 Bridge, Warren, Ohio..... 8- 6
8-24 Bridge, Colville, Wash..... 8- 6
8-26 Bridge, Norristown, Pa..... 8- 6
8-31*Bridge, Cuba (U. S. Possess.).... 7-30
9- 2*Bridge equip., Chicago, Ill. 7-30

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8- 8 Plans, Kingston, R. I..... 7-23
8- 8 Cottages, Hudson, N. Y..... 7-30
8-10 Church, St. Paul, Minn..... 7-30
8-10 Building, Rome, N. Y..... 7-30
8-10*Post-office, etc., San Francisco, Cal 7- 2
8-10 Refrigerating plant, Rochester, N. Y. .....(Mfg. Pl.) 7-30
8-10 School, Bridgeport, Conn. 8- 6
8-10 Work-house, Indianapolis, Ind.. 8- 6
8-11*Post-office, Bedford, Ind. 7- 9
8-11 Bldg. addition, Albion, N. Y..... 7-30
8-12*Boilers, Poughkeepsie, N. Y..... 7-30
8-12 Post-office, Anderson, S. C..... 7- 2
8-15 Hospital, Boise, Idaho..... 7-30
8-15 Building, New York, N. Y..... 7-23
8-17 Building, Grand Rapids, Minn.... 7-30
8-17 Engine houses, New York..... 8- 6
8-19 Court-house, Indianapolis, Ind... 8- 6
8-19 Armory, Ionia, Mich..... 7-30
8-19 Armory, Pontiac, Mich..... 7-30
8-19*Post-office, Petersburg, Va 7-16
8-20 Hospital, Pittsburg, Pa..... 7-23
8-20 Storehouse, New York, N. Y..... 8- 6
8-20 Pub. library, New York, N. Y..... 8- 6
8-24*Post-office, Logan, Utah..... 7-16
8-27*Hospital repairs, Ft. Hancock, N. J. 7-30
8-31 Post-office extension, Little Rock, Ark..... 7-23
9- 1 School plans, St. Paul, Minn. 7- 9
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9-14 Post-office, St. Louis, Mo..... 8- 6
9-22 Laboratory, etc., Ann Arbor, Mich. 7-23
9-22 Court-house, Green Bay, Wis.... 6-18
9-30 Post-office, Cape Girardeau, Mo. 8- 6

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8-10 Reservoir, Franklin Park, Ill.... 8- 6
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8-12 Pumping equip., New York 7-30
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8-14*Reservoir, Lincoln, Neb. 7-30
8-14*Water-works, De Funiak Springs, Fla. 7-30
8-15*Chimney, Dallas, Tex..... 7-30
8-15 Boilers, Philadelphia, Pa..... 7-30
8-15 Well, Los Angeles, Cal..... 8- 6
8-17 Water system, Chehalis, Wash.... 8- 6
8-17 Basin, Tulsa, Okla..... 8- 6
8-17*Pipe, Yonkers, N. Y. 7-30
8-18 Conduit system, Green Bay, Wis.. 7-23
8-18*Water-works, Brandon, Vt..... 8- 6
8-19*Pumping plant, equipment, Jerseyville, Ill. 7-23
8-20 Water-works, Hospers, Iowa 8- 6
8-24*Water-works, Rockville, Ind..... 8- 6
8-25 Filters, etc., Peekskill, N. Y..... 8- 6
8-25*Conduit, Toledo, Ohio 8- 6
8-27 Dam, Orland, Cal. 6-11
8-29 Water tank, Ft. Barrancas, Fla.. 8- 6
9- 1 Water plant, Russellville, Ala.. 7-23
9- 1*Concrete conduit, New York, N.Y. 7-30
9- 1*Filtration plant, Winnetka, Ill.... 8- 6
9-24*Filtration plant, Evansville, Ind.. 8- 6

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8- 7*Sewer, Springfield, Ohio..... 7-30
8- 7 Sewer, Spencer, Iowa..... 8- 6
8- 7 Sewer, Elkhart, Ind..... 8- 6
8- 8 Sewer system, Toccoa, Ga..... 7-23
8-10 Sewer, Larned, Kan..... 7-30
8-10 Sewer, Carthage, Mo..... 8- 6
8-11 Sewer, Long Island City, N. Y.. 7-30
8-13*Sewer pipe, etc., Moorestown, N. J. 8- 6
8-14 Sewers, Buffalo, N. Y..... 8- 6
8-14 Sewers, Salt Lake City, Utah..... 8- 6
8-14 Sewers, Youngstown, Ohio..... 8- 6
8-14*Sewer, Louisville, Ky..... 7-30
8-17*Sewer pipe, Brantford, Ont..... 8- 6
8-17 Sewers, Washington, D. C..... 8- 6
8-17 Sewers, East Liverpool, Ohio..... 8- 6
8-17*Sewers, Canajoharie, N. Y..... 8- 6
8-18*Sewers, Dalhart, Tex 8- 6
8-20*Sewers, Forest City, Pa. 7-30
8-21*Sewer, Louisville, Ky..... 7-30
9- 1 Sewer, Jackson, Ohio 7-23
9- 7*Sewers, Vicksburg, Miss..... 7-30

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8-10*Grading, Van Buren, Ark..... 7-23
8-10*Paving, Newburgh, N. Y. 7-30
8-10*Grading, etc., Verona, N. J..... 7-16
8-10*Pavement, Port Chester, N. Y.... 7-30
8-10 Asphalt, New York, N. Y..... 7-30
8-10 Paving, Spartanburg, S. C..... 7-30
8-10 Road, Clearfield, Pa..... 8- 6
8-11 Road work, Hartford, Conn..... 8- 6
8-11*Sidewalk, Saranac Lake, N. Y.... 7-30
8-11 Regulating, etc., Long Island City, N. Y. 7-30
8-12*Curb, etc., Eureka, Ill. 7-30
8-12 Grading, etc., Carrollton, Ohio.... 7-23
8-14*Roads, Phillipsburg, N. J..... 7-23
8-14 Grading, Memphis, Tenn..... 7-30
8-15 Street impvt, Hot Springs, Ark.. 8- 6
8-15 Road, Jacksboro, Tenn..... 8- 6
8-17 Road, Fowler, Ind..... 8- 6
8-17*Paving, Asbury Park, N. J..... 8- 6
8-18*Pavt., etc., Saranac Lake, N. Y.. 8- 6
8-19 Regulating, etc., Brooklyn, N. Y.. 8- 6
8-22 Road, Pierre Haute, Ind..... 8- 6
8-23 Road, Brookville, Ind 7-23
8-25*Pavement, Norfolk, Neb..... 8- 6
8-27*Pavement, Westfield, N. J..... 8- 6
8-31*Street impvt., Mineola, N. Y..... 8- 6

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8- 8 Garbage plant, Tarentum, Pa..... 8- 6
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8-10*Abutment, Wheeling, W. Va..... 7-30
8-10 Mosquito Cars, New York 8- 6
8-11 Block signals, New York 8- 6
8-11*Cement, Columbus, Ohio 7-30
8-11 Barge canal, Albany, N. Y..... 7-23
8-11*Dredging, Trenton, N. J..... 7-16
8-11 Dredging, Columbus, Ohio..... 8- 6
8-12 Ditches, Fulton, Ill 8- 6
8-12 Piers, Baltimore, Md. 8- 6
8-12*Cement, Chicago, Ill 7-23
8-13*Wooden scow, New York, N. Y.. 7-23
8-13 Metal tree guards, New York 8- 6
8-13 Locomotives, dump cars, Panama. 8- 6
8-13 Drain, Rockwell City, Ia..... 8- 6
8-14 Dredging, Oakland, Cal. 8- 6
8-14 Light-house, Alaska 5-21
8-17 Shop machines, drills, etc., Panama. 8- 6
8-18*Dredging, Trenton, N. J..... 7-30
8-18*Coal handling machinery, Philadelphia, Pa 7-30
8-20 Trans-Continental Ry, Ottawa, Ont. (Railways) 7-30
8-22*Stone, New York 8- 6
8-24 Cars, gages, cross-ties, Panama.. 8- 6
8-24*Cement, Detroit, Mich 7-30
8-24*Earth excavation, Detroit, Mich.. 7-30
8-25*Crematory, Fort Andrews, Mass.. 7-30
8-26*Metal work, Hawaii 7-30
8-26*Revetment, etc., Milwaukee, Wis. 7-30
8-26*Riprap seawall, Boston, Mass.... 7-30
8-25*Seawall, Ft. Mason, Cal. 8- 6
8-29*Garbage removal, Youngstown, O. 7-30
8-31*Dredge, Petersburg, Va. 7-30
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8-27 Water-works, Egypt 8- 6
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10-14 Dredging, Spain 7-16
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11- 4 Reservoir, India 8- 6
12- 1*Sewers, paving, Ecuador 8- 6

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8- 5 Engr. Wood Preservation—Wash., D. C. 7-23
8-12 Assistant—Washington, D. C..... 7-23

RAILWAYS.

(denotes that this work is advertised in Engineering News.)*

ALBERTA & BRITISH COLUMBIA.—We are officially advised that surveys have been run for this proposed railway. It will extend from the international boundary, at crossing of Kootenay River, to Calgary, Alta., 175 miles. Construction will be heavy. Capital and right-of-way are obtained. J. J. Carrick is Pres.; H. E. Knobel is Ch.-Engr.; J. J. O'Connor is Secy., all at Port Arthur, Ont. Noted on June 25.

BAIE DES CHALEURS RY.—Bids will be received until noon, Sept. 9, by L. A. Audette, Registrar of the Exchequer Court of Canada, Ottawa, Ont., for the purchase of this line, rolling stock, etc. Railway runs from Metapedia to Caplin, Que., a distance of 80 miles, connecting with other lines at each end.

BEAVER VALLEY & NORTHWESTERN.—Dr. J. M. Kerns, Sunset, Okla., Gen. Mgr., advises us that this company proposes to build a railroad in Oklahoma from Gage, via Beaver, to the Chicago, Rock Island & Pacific Ry., a distance of 120 miles. Surveys are now being made. Capital for construction and right-of-way have been obtained. R. A. Perkins is Ch. Engr., Beaver, Okla. The incorporation of this company, "Oklahoma, Beaver & Western," was noted on July 2.

CAROLINA VALLEY.—This company, which operates a railway extending from Thomasville to Denton, N. C., 21 miles, which was recently put in the hands of receivers, is to be sold by order of the court on Aug. 17. Dee Allen is Pres., High Point, N. C.

CINCINNATI, KENTUCKY & VIRGINIA.—We are officially informed that this railway will be built through the Licking River Valley in Kentucky. It will be 275 miles long, with branches. Surveys are now being made. About 75 miles of right-of-way and some capital have been secured. The construction will be heavy, including trestles, bridges and tunnels. Date for letting contracts has not been definitely decided. Harold R. Stone is Pres., 211 Railway Exchange Bldg., Chicago; W. D. Gerber, Yale, Ky., is Ch. Engr. Noted on June 18. Mr. Stone is Pres. of the Licking River R. R. Co., which operates 32 miles of line in Kentucky.

DEXTER & NORTHERN.—This company has been organized to operate a steam railroad, 1¾ miles long, from Dexter to Dexter Junction, N. Y., on the line of the Cape Vincent branch of the Rome, Watertown & Ogdensburg R. R. The directors of the company are Charles Campbell, New York City; J. E. Campbell, Dexter; L. G. De Grant, Watertown, and J. A. Outterson, of Carthage, N. Y.

DENVER & RIO GRANDE.—The stockholders of the Denver & Rio Grande and the Rio Grande Western companies, at a meeting in Denver on July 25, voted to consolidate the two companies under the name of the Denver & Rio Grande Ry. Co., and at the same time authorized an issue of $150,000,000 in bonds. The new issue will be used to retire all outstanding bonds of the two roads, make necessary improvements and extensions and further finance the construction of the Western Pacific. All the Rio Grande roads except the Rio Grande Southern are now in one company. The disposition of the Utah Fuel Co., which is owned by the Rio Grande Western, did not come before the meeting, it having been decided to hold this matter in abeyance until the test case now before the courts decides the constitutionality of the law prohibiting railroads doing an interstate business from owning coal companies, according to the New York "Tribune." Directors of the consolidated company were elected as follows: George J. Gould, E. T. Jeffery, Winslow S. Pierce, Amos H. Calef, Howard Gould, Arthur Coppell, Edwin Gould, C. H. Schlacks and Joel F. Vail.

ESTACADO & GULF.—W. A. Butts, Pres., Roby, Tex., advises us that grading has been finished from Roby to McCaulley, Tex., (on the Kansas City, Mexico & Orient Ry.), 14 miles; grading is in progress east of McCaulley. Track material is purchased and partly delivered. The railway will run from Roby to Coleman, Tex., 100 miles. Right-of-way and capital are secured. Surveys are partly made. T. H. Landon is Ch. Engr., Roby. Noted on June 18.

FLORIDA.—Contract has been awarded to C. H. TURNER CONSTRUCTION CO., Pensacola, Fla., by Capt. D. W. Hand, Constructing Q. M., Fort Barrancas, Fla., for material and labor required in repair and extension of railroad tracks at this post.

We are officially informed that the Bureau of Yards and Docks, Navy Dept., received the following bid on Aug. 1 for the construction of a marine railway at the Naval Station, Key West, Fla.: The H. I. Crandall & Son Co., 102 Border St., East Boston, Mass., (6) $25,100; (7) $18,500.

GAINESVILLE, WHITESBORO & SHERMAN.—We are officially advised that "grading is progressing rapidly. The grade is completed twelve miles out and company hopes to have first division finished inside of the next month. The line runs from Gainesville to Sherman, Tex., a distance of 39 miles and is a first-class line. Track will start out of Gainesville, just as soon as the grade is completed into Whitesboro. L. M. McArthur is Ch. Engr., at Gainesville, Tex. T. M. Bosson, Secy., Gainesville."

GALATIA, HARRISBURG & SOUTHEASTERN.—Incorporated at Springfield, Ill., to construct a railway from Galatia, in Saline County, to a point on the Ohio River in Hardin County. The incorporators are John W. Shaw, J. B. Ford, J. E. Dorris, Jr., and C. M. Warren, of Harrisburg, Ill., and A. J. Webber of Galatia, Ill. The capital stock is $50,000.

MARIETTA, COLUMBUS & CLEVELAND.—James T. Blair, of Parkersburg, W. Va., Pres. of the Marietta, Columbus & Cleveland Railroad Co., was appointed receiver for this road by Federal Judge Sater on July 31 on application of the Pennsylvania Railroad Co. The plaintiff alleges that it owns $2,000 of the capital stock of the defendant company and also that the company is indebted to them for $30,683 lent at various times. The petition states that the company intended to build Columbus to Cleveland, but that it only got from Marietta to Palos, 49 miles, when the capital was exhausted.

MODOC NORTHERN.—Incorporated in California to build a line 100 miles long, beginning near Alturas, in Modoc County, Cal., in a northwesterly direction to a point on the California Northeastern Railway, near Klamath Falls, Ore. The headquarters of the company are San Francisco. It is capitalized at $3,000,000. The directors are as follows: E. E. Calvin, William F. Herrin, William Hood, W. R. Scott, J. L. Wilcutt; C. H. Redington is Treas.

MONTGOMERY & COLUMBUS.—J. Albert Kirven, of Columbus, Ga., has been appointed chairman of a committee by the Columbus Board of Trade to make application for a charter for the Montgomery & Columbus Railroad Co. It will build a line 78 miles long, from Columbus, Ga., westward to Montgomery, Ala., via Crawford, Marvin, Society Hill, Tuskegee and other towns.

MOUNTAIN HOME & WHITE RIVER.—W. L. Marshall, Pres., Mountain Home, Ark., advises us that contracts will be let by this company when capital is secured. The line will be eleven miles long, and will connect the county seat of Baxter County, Ark., with the Missouri Pacific Ry. Surveys are made and right-of-way secured. The proposition carries with it a good donation of timber, right-of-way, etc. Previously noted.

NEW YORK, NEW HAVEN & HARTFORD.—Company has had its petition granted by the Railroad Commissioners, Connecticut, for the abandonment of ten railroad crossings on the branch running from Bethel and Newtown to Hawleyville, Conn.

OCEAN SHORE RY.—Contracts have been awarded to the RANSOME CONSTRUCTION CO., of San Francisco, the HUMBOLDT CONSTRUCTION CO., San Francisco, and LILLY & HEINS, Santa Cruz, Cal., for building 37 miles of railway between Granada and Scotts Creek, Cal. Ralph W. Heins and C. E. Lilly, of Santa Cruz, will grade the roadbed from Granada to San Gregorio and from Pescadero to Folger, a total distance of 33 miles. The Ransome Construction Company (Hugh Crummey, Mgr.), will build the four miles from San Gregorio to Pescadero, under a previous arrangement and the Humboldt Construction Co. will build the bridges. This section will be a connecting link between two portions now in operation, as follows: Between San Francisco and Granada, 27½ miles; and between Santa Cruz and Folger, 16½ miles. J. D. Harvey is Pres. and J. B. Rogers is Ch. Engr., 52 Eleventh St., San Francisco.

PANAMA.—Bids are asked for locomotives, dump cars, flat cars, cross-ties, cable railways, etc.—See under "U. S. Possessions."

REDDING, AFTERTHOUGHT & NORTHEASTERN.—We are officially advised that date for letting contracts has not been set. Surveys were completed on July 14. This railway will run from Bella Vista to Ingot, Cal., 14 miles. It may be extended from Ingot to Redding, eleven miles. Nearly all necessary capital and right-of-way have been obtained. Henry Rickel is Pres. and F. J. Dearborn is Ch. Engr., Ingot.

ROME & OSCEOLA.—The Public Service Commission, Second District, Albany, N. Y., on Aug. 1 authorized the Rome & Osceola Railroad Co. to build a steam railroad from Rome north to Osceola, Lewis County, a distance of 25 miles, serving the towns of Lorena, Lee Center, Point Rock and Swancote Mills. W. Pierpont White is Pres., Utica, N. Y. The company has stipulated that the construction of the proposed road shall be made from the proceeds of the capital stock, when issued, and not in any other manner. The capital stock of the company is $500,000. The promoters say that the line will serve an area of 250 sq. miles, or 160,000 acres, which is now remote from market on account of lack of transportation. It

is estimated that there is 375,000,000 ft. of timber in this area, besides other natural products. The commission has issued its order as to the manner of crossing public highways by the Cortland & Auburn Railroad Co., which is about to build a line between Cortland and Auburn. Fully noted on June 11.

VANCOUVER, WESTMINSTER & YUKON (Great Northern).—This company has received a Dominion Government subsidy for a 100-mile line from Vancouver, B. C., northerly in the direction of Fort George. A. Stewart is Asst. Ch. Engr., Great Northern Ry., Seattle, Wash.

WABASH.—The PEOPLES CONSTRUCTION CO., Davenport, Iowa, has received contract for ballasting Wabash R. R. roadbed in Missouri, necessitating about 200,000 yds. of filling. J. W. Crowley is Pres. of the construction company.

WACO, HAMILTON & BROWNWOOD.—Stephen Turner, Ch. Engr., Waco, Tex., informs us that this railroad will be about 132 miles in length, connecting Waco and Brownwood, Tex. Preliminary survey has been made. Capital and right-of-way have not been secured. Date for letting contracts is indefinite. J. B. Baker, Waco, is Pres.

ELECTRIC RAILWAYS.

MIDDLETOWN, CONN.—The New York, New Haven & Hartford Railroad Co. has awarded the contract for the construction of the trolley extension from Middletown to Wethersfield, a distance of about 13 miles, to C. W. BLAKESLEE & SONS, of New Haven, Conn. The Railroad Commissioners will give a hearing on the question of the approval of the proposed lay-out. Noted on July 23.

NEW YORK, N. Y.—Justice Erlanger in the Supreme Court on July 24 denied the application of the New York City Interborough Ry. Co. to change its name to the Bronx Crosstown Ry. The decision is cited as follows: "It is shown that the use of the word 'Bronx' in the proposed new name is open to the very objection suggested by the petitioners, as there is now a railroad company known as the Bronx Traction Co., which is a subsidiary corporation of the Union Railway Co., now in the hands of a receiver, and that the word 'Crosstown' in the proposed new name is misleading, as several of the petitioners' lines run north and south and not east and west." The company operates five miles of line from Broadway and 181st St. to Third Ave. About eleven miles of railway have been constructed. H. M. Fisher is Secy.

ADDISON JUNCTION, N. Y.—The Champlain & Sanford R. R. Co. has agreed to operate its proposed road with electricity instead of steam power. The company has applied for a charter to build and operate a road 58 miles long in Essex County, N. Y. The road is to start at Addison Junction (Fort Ticonderoga post-office) and will run in a southerly direction past Schroon and Loon Lakes, to a junction with the Adirondack division of the Delaware & Hudson at Riverside. Capital stock, $600,000. The incorporators and board of directors are as follows: Charles M. Hyatt, P. O. Box 118; Andrew Thompson, P. O. Box 118; James MacN. Thompson, P. O. Box 118; Guy D. Hills, P. O. Box 118; David A. Thompson, 13 North Pearl St.; Lewis R. Parker, 25 North Pearl St.; Andrew B. Jones, 520 Broadway; Sydney T. Jones, 520 Broadway, and MacNaughton Miller, 200 Washington Ave., all of Albany, N. Y. Company's offices are in the Home Savings Bank Bldg., Albany. Noted under Railways on June 18.

ADDISON, N. Y.—The charter of the Tuscarora Valley Traction Co. will expire on Oct. 1, 1908, unless construction work is commenced by that time. W. E. Barron and E. C. Smith, of Addison, are taking local subscriptions for building a section of the railway. It is proposed to build from Addison to Jasper and Woodhull, Steuben County.

SYRACUSE, N. Y.—At a meeting held on July 24th the citizens of Pompey and Fabius unanimously voted to subscribe $85,000 (or $5,000 for each mile) to secure an extension of the Syracuse & Suburban R. R. Co. to Cuyler, a distance of 17 miles. A committee of nine has been appointed to confer with Charles E. Hubbell, Pres., of the Syracuse & Suburban Co., to work out the details of the matter.

ROCHESTER, N. Y.—The Public Service Commission, Second District, Albany, N. Y., has announced that it had issued a supplemental order permitting the Rochester, Corning & Elmira Traction Co. to issue capital stock to the amount of $380,000 par value and $1,000,000 in bonds, par value. It is provided that the proceeds of the stock or bonds be used exclusively for the construction and equipment of that part of the proposed road from Rochester to Conesus Lake, and that any excess shall be held for further order of the commission. The original application of the company was for the issuance of $8,000,000 in bonds and of the balance of its stock of $3,880,000. The company had previously issued $120,000 capital stock. The first order of the Commission permitted an issue of $4,120,000 in bonds and the full issue of $4,000,000 in stock. The Commission required that the capital stock be subscribed to by responsible parties before any bonds could be issued, which money should receive no return until after the interest of the bonds was paid. The promoters of the road reported it was impossible to dispose of the stocks and bonds under these conditions, but stated they would be able to do so if they were allowed first to construct and put in operation that part of the road from Rochester to Conesus Lake, a distance of 25 miles, at an estimated cost of $1,350,000. It was for the purpose of raising this money that the new order was granted. Noted on July 16. The ROCHESTER & SOUTHERN CONSTRUCTION CO., 624 Exchange St., Rochester, N. Y., has contract.

JOHNSTOWN, PA.—The Southmont St. Ry. Co. has been incorporated to construct an electric railway to connect Johnstown with Southmont and Westmont. Capital stock, $100,000. Incorporators: Frank W. Otto; and T. Coleman du Pont, Wilmington, Del., Pres. of the Johnstown Passenger Railway.

WASHINGTON, D. C.—The Baltimore & Washington Transit Co. has filed $1,000 deposit with the Tax Collector, District of Columbia, to guarantee the construction of the railway. This company operates a trolley road extending from Takoma to Glen Sligo, two miles, opened Sept., 1897, and by a traffic agreement with the Brightwood Electric runs cars into Washington, where transfers are given to city lines. Extension is proposed to Sandy Spring, Md., 14 miles. A new line in Takoma Park is also proposed, which may be operated by American monorail system. Stock, $100,000. The officers of the company are: Pres., Henry W. Williams, of Baltimore, Md.; Vice-Pres. and Gen. Mgr., William A. Mellen, Washington; Secy., George Schedel, Baltimore; Treas., Norton M. Little, Washington; General Counsel, Williams, Thomas & Williams, of Baltimore. The Board of Directors is composed of Henry W. Williams and George Schedel, of Baltimore; William A. Mellen, Howard Fisk, William M. Terrell, Norton M. Little, of Washington, and Dr. E. H. Leffler, of Millersburg, Pa.

ASHEVILLE, N. C.—The ASHEVILLE FUEL, DRAY & CONSTRUCTION CO., of this city, has been given the contract to build the line for the Weaverville Electric Co., four miles long, from Newbridge Station, on the Asheville Rapid Transit line to Weaverville. B. M. Lee is Engr.-in-Charge. R. M. Ramsey is Mgr. Noted on July 16.

CHATTANOOGA, TENN.—We are officially advised that the Grand View Coal & Timber Co. will build an aerial railway, 5,200 ft. long, from Tennessee River north on Walden's Ridge, which is to be extended five miles. Robert Marshall is Pres. and W. H. Strickler is Ch. Engr., Chattanooga, Tenn. Contractor is the CONSOLIDATED TRAMWAY CO., Roanoke, Va., W. C. Lawson, Pres. Right-of-way and capital are secured. Survey has been made. Noted on July 2.

MOUNT VERNON, OHIO.—Pursuant to an order of the Court of Common Pleas of Knox County, Ohio, F. V. Owens, Receiver, will offer at public auction at Mount Vernon, Ohio, on Sept. 12, 1908, the entire property including a street railway operating over streets of the city to a park of 40 acres two miles from the city, rolling stock and equipment, a 25-year franchise, power-house and city and commercial lighting plant. Terms of sale, one-third cash, balance in one and two years.

ELKHART, IND.—The St. Joseph Valley Traction Co. will complete its line this year from Angola, Ind., to Pioneer, Ohio. H. E. Bucklen is Pres. and Gen. Mgr., Chicago, Ill. This company now operates about 70 miles of line. M. L. Swinehart, Lagrange, Ind., is Ch. Engr.

INDIANAPOLIS, IND.—We are officially advised that bids will be received on Aug. 20 by the Indianapolis, New Castle & Toledo Elec. Ry. Co. for the completion of its line, upon which no construction has been done since Nov., 1907. There are 23 miles of track to be completed; grading is all done except one 50-ft. span bridge and one wagon subway. Overhead work almost completed. Two 750-KW. units, power substation, four 300-KW. rotaries, six passenger cars, two express cars and piping will be required. Estimated cost, $350,000. Paul H. White, Indianapolis, is Engr. The Union Trust Co. is Receiver. Noted fully on July 23.

WOOD RIVER, ILL.—We are officially informed that the Wood River, East Alton & Bunker Hill Traction Co. has secured right-of-way for its proposed line, which will extend from Wood River to Gillespie, Ill., via East Alton and Bunker Hill, 20 miles. Surveys have been made. Sheppard & Morgan, Edwardsville, Ill., are the Engrs. J. T. W. Rudesill, East St. Louis, Ill., is Pres. Noted fully on May 28.

KILBOURN, WIS.—We are officially advised that the Central Wisconsin Transit Co. has applied for charter in Wisconsin to build a railroad to be operated by electricity or steam, from Kilbourn, through Adams County, to Grand Rapids, Wis., a distance of about 65 miles. The capital stock is nominally $25,000. Headquarters of the road will be at Kilbourn, Wis. The incorporators and first Board of Directors are J. J. Burns and Clyde F. Burns, of Chicago, and Geo. H. Campbell, R. Wintermute and William Sweet, of Kilbourn. Construction of this road entire will be in charge of BURNS & CO., 705 Isabella Bldg., Chicago.

POY SIPPI, WIS.—The Wisconsin Northeastern Ry. Co. has been incorporated in Wisconsin to construct a line from Poy Sippi to Red Granite, Wis., a distance of eight miles. Capital stock, $60,000. Incorporators, John Moffatt, H. W. Colt, H. A. Dewey, Charles A. Benedict and W. H. Paulson, all of Poy Sippi.

COLFAX SPRINGS, IOWA.—The Colfax Springs Ry. Co. has been incorporated in Iowa. The company has a capital of $25,000. It proposes to construct an electric railway in Colfax and through Jasper County from a point near the Rock Island depot to the hotel at Colfax Springs, a distance of about two miles. The officers of the company are: Frank B. Hooper, Pres.; James P. Donahue, Vice-Pres. and Treas.; John W. Martin, Secy. The incorporators are James P. Donahue and Dick R. Lane, Davenport, Iowa.

EMMETSBURG, IOWA.—We are officially advised that the following Board of Directors of the Spirit Lake, Emmetsburg & Fort Dodge Ry. Co. was elected at a recent meeting of stockholders: A. R. Loomis, J. J. Ryan, M. H. Miller, W. E. G. Saunders, W. T. Brannigan, S. H. Gill, M. P. Kerwick, J. M. Daly, H. W. Beebee, P. J. Lodis and E. A. Morling. At a meeting of the new board the following officers were elected: W. E. G. Saunders, Pres.; M. H. Miller, Vice-Pres.; T. O. Repsell, Secy.; D. A. Johnson, Treas. Reports indicate the project as making encouraging headway along the line. Only a comparatively small number of signatures is needed in Fort Dodge to call a special election, and this number will soon be secured. Noted fully on July 9.

ERIE, KAN.—The Kansas Southern Elec. Ry. Co. has been granted a franchise to construct its line through this city. F. V. Crouch, Iola, Kan., is Pres.

CHEYENNE, WYO.—We are officially informed that the Cheyenne St. Ry. is building four miles of line with its own forces. Work is half completed. Noted on June 18.

PARIS, TEX.—The Texas Union Traction Co. will build a 25-mile standard-gage electric railway from Paris to Bogata, Tex. The preliminary surveys have already been made. The overhead trolley system will be adopted and the power station will be built at Paris. No contracts have been awarded. C. P. Moore, Longfellow, Tex., is Pres. John T. Upchurch, Clarksville, Tex., Treas.

EDMONTON, ALTA.—The City Council is considering plans for a municipal street railway to cost approximately $125,000. Noted on May 7.

PANAMA.—*Cable Railways.—See under U. S. Possessions.

LIGHT AND POWER PLANTS.

(denotes that this work is advertised in Engineering News.)*

CLINTON, MASS.—The city has voted in favor of municipal ownership of the local electric light and gas plants now owned by the Massachusetts Lighting Companies, and also has authorized the special investigating committee to engage an expert. $500 has been appropriated for the cost of the same.

ALBION, N. Y.—Sanford T. Church, Receiver for the Albion Power Co. is making arrangements for financing the necessary improvements to the property of the company in accordance with the decision of the Public Service Commission of the Second District, as noted above. The Commission requires the company to expend about $21,000 in improvements to its plants in Albion, Waterport, Clark Mills and Brockport. The dam at Waterport will be replanked; new boilers will be installed in the Albion power house; new shafts and water wheel at Waterport station No. 1, so as to make available the 150-KW. generator there; repairs to timber dam and crib at Waterport station No. 1, so as to increase the available head and power at that dam.

ALBION, N. Y.—After an investigation in regard to complaints made by the citizens in regard to the poor service of the Albion Power Co. and the application of the Swett Electric Light & Power Co. for a franchise to furnish electric service in Albion, the Public Service Commission of the Second District has given the receiver of the Albion Power Co. an opportunity to begin at once certain improvements, to be completed within 30 days and others within 60 days, it is stated. The application of the Swett Electric Light & Power Co. is held open for 30 days. If at the end of that time the improvements required have not been undertaken to the satisfaction of the commission, the application of the Swett Co. will be taken up. The Albion Co. is required to rehabilitate its water power plant, make necessary repairs to its boilers and purchase and install a 900-KW. belt-driven generator, with other necessary appliances and to erect additional transmission lines necessary to give proper service in Albion. The company is also required to install the following apparatus: Three 500-KW., 6,600-13,200-volt transformers, with necessary connections; new arc-lamp system, proper switchboard devices on its entire system, exciter regulators, single-phase feeder regulators. Wallace C. Johnson, Niagara Falls, is Mgr. of the Albion Power Co.

DELMAR, N. Y.—Bids are asked by George J. Coughtry, Town Clerk, until 3 p. m., Aug. 12, for lighting the streets of Delmar, N. Y.

SYRACUSE, N. Y.—The Onondaga County Commissioners are having plans prepared for a detached power building to furnish power, heating and lighting at the new Onondaga County Home (now under construction at a cost of $300,000). Specifications for power building will be finished and bids will be called for about Sept. 1. Capacity, 1,000 lights. Power plant is to consist of three horizontal tubular boilers, 150-HP. capacity, equipped with ash and coal handling machinery. Three generators direct connected to automatic high-speed engines with capacity to generate 75 KW. each.

TAKOMA (Washington post-office), D. C.—Bids are asked until noon, Aug. 15, by Capt. H. L. Pettus, Q. M., for installing approximately 1,100 lin. ft. 4-way electric conduit, with necessary manholes, etc., at Walter Reed Army General Hospital, Washington, D. C.

WASHINGTON, D. C.—Bids were received at the office of Elliott Woods, Supt. U. S. Capitol Bldg. and Grounds, on July 25, for furnishing 2,134 electric lighting fixtures for the office building, U. S. Senate (bid A, statuary bronze and old brass; bid B, statuary bronze, old brass, old silver and polished silver) as follows: Lawrence Gas Fixture Mfg. Co., 1260 North Twelfth St., Philadelphia, Pa., (A) $45,157, (B) $47,519; Sterling Bronze Co., 113 West 25th St., New York, (A) $57,294, (B) $58,330; The Enos Co., 16th St. and Seventh Ave., New York, (A) $42,613, (B) $45,132; Wahle, Phillips Co., 551 West 52d St., New York (A) $37,482, (B) $39,515; Cassidy & Son Mfg. Co., 133 West 23d St., New York (A) $52,845, (B) $55,177; Lloyd, Garrett Co., 2115 Wood St., Philadelphia, Pa., (A) $54,936, (B) $58,683; The Mitchell Vance Co., 836 Broadway, New York, (A) $35,000, (B) $35,521; L. Plaut & Co., 432 East 23d St., New York, (A) $42,856, (B) $43,887; J. B. McCoy & Son, 114 West 30th St., New York, (A) $40,500; The David J. Braun Mfg. Co., Washington and Union Sts., Chicago, Ill., (A) $37,646, (B) $40,573.

PULASKI, VA.—John T. Loving, Mayor, advises us that the city has voted $75,000 of bonds to establish hydro-electric power plant. It will be installed at cost of $50,000. Edgar C. Wiley, Law Bldg., Lynchburg, Va., is Engr. Nothing will be done to establish this plant until bonds (10-year, 5% coupon bonds) are sold and money in hand. Noted on July 9.

*WHEELING, W. VA.—Bids are asked until 11 a. m., Aug. 31, by Capt. [illegible] Statter, Corps Engrs., U. S. A., for [illegible] a power-house at Dam No. 13, Ohio River.

FAYETTEVILLE, N. C.—Articles of incorporation have been filed for the Little River Power & Transportation Co. D. McNeill, J. F. Gilmore and [illegible] by W. MacRae. The company is capitalized at $100,000. It proposes to operate [illegible] electric light and power plants.

TAMPA, FLA.—The Tampa Electric Co. has contracted with the STONE & WEBSTER ENGINEERING CORPORATION, Boston, Mass., for enlargement of main power station on West Jackson [illegible] Tampa, and numerous improvements in the [illegible] and power service of the city. The building will be enlarged sufficiently to house two turbine units with all necessary steam and electrical auxiliaries in addition to the present equipment. One [illegible]-generator of 1,500-KW. capacity, arranged to generate current at 2,300 volts, with a 525-HP. water tube boiler will be immediately installed. The present overhead [illegible] cuits of the company carry 133 [illegible] rent. These circuits will be reconstructed for 60-cycle current and extended and the present meters will be readjusted or replaced by three-wire lighting and two-phase power meters. The present 133-cycle overhead power circuits will be rebuilt to carry 60-cycle, two-phase current with corresponding changes in service connections, building, wiring and in meters. The work planned will cost over $250,000.

ALBERTVILLE, ALA.—The Commercial Club, of which Dr. J. R. Thomas is Pres., is promoting project to build an electric light plant and water-works.

NEW BREMEN, OHIO.—Bids are asked by the Village Council of New Bremen, Auglaize County, Ohio, until noon, Aug. 24, for erecting a complete A. C. 2-phase, 60-cycle, 2,300-volt system, in accordance with specifications, copies of which may be obtained at the office of F. W. Schroeder, Jr., Village Clerk, New Bremen, Ohio, or at the office of the Franklin Engineering Co., 44 Douglas Bldg., Columbus, Ohio.

CANTON, OHIO.—The Local Board of Service has awarded the CANTON ELECTRIC CO. the contract for 193 additional arc lamps at $41.50 a lamp per year. The lamps are to be of 2,000 c. p. each and to be lighted 2,500 hours per year. The contract covers a period of ten years. The same company holds a contract for the 462 arc lamps that are being burned at present, and the additional lamps awarded are to replace gas lamps.

HARTFORD CITY, IND.—We are officially informed that all contracts have been let by the Hartford City Lighting Co. for improving its plant. Estimated cost, $25,000. W. H. Yule is Supt. Noted on July 2.

PESHTIGO, WIS.—Bids are asked until Aug. 12 by the Northern Hydro Electric Power Co., of Green Bay, Wis., to construct a plant of 8,000 HP. on Peshtigo River. A power-house and a 400-ft dam will be constructed. Plans are being prepared by D. Mead, of Madison. Capital, $1,000,000. Probable cost of work, $500,000. S. H. Josslyn, of Oshkosh, Wis., has been appointed Pres., O. M. Murphy, Vice-Pres.; B. L. Papler, Secy., and Frank A. Murphy, Treas. The last three officers are of Green Bay.

GREEN BAY, WIS.—Bids are asked until 3 p. m., Aug. 18, by James Knox Taylor, Supervy. Arch., Treasury Dept., Washington, D. C., for the installation of a conduit and wiring system in the U. S. post-office and court-house at Green Bay, Wis. German & Lignell are Archs., Duluth, Minn.

ATCHISON, KAN.—Contracts for remodeling the municipal electric light plant have been let to the GENERAL ELECTRIC CO., of Schenectady, N. Y. The cost of the work is estimated at about $30,000. Fred Giddings is City Engr. W. P. Waggener, Atchison, is Pres.

GENOA, NEB.—JOHN W. EARLY, of Columbus, Neb., advises us that he has been awarded contract by the Village Council for the proposed municipal electric light system. The cost of the plant is estimated at $11,000. The plant will be operated by steam.

VALLEY CITY, S. DAK.—H. F. Halverson, City Audr., states that J. A. Murray, of Wilkes-Barre, Pa., bid $25,000 for a 20-year lease of the municipal electric-light plant, payment to be made in service. The bid was rejected and no further bids will be called for.

HELENA, MONT.—Contracts have been awarded to STONE & WEBSTER, 147 Milk St., Boston, Mass., for rebuilding the Hauser Lake dam and the construction of the Wolf Creek dam. Work will begin at once. The Helena Commercial Club is interested.

SEATTLE, WASH.—L. B. Youngs, Supt. of the municipal electric light plant, has applied to the City Council for an appropriation of $288,400 for extensions to the plant and city lighting system.

LOS ANGELES, CAL.—It is stated that Henry E. Huntington and associates in the Pacific Light & Power Co. have acquired the plant and system of the City Gas Co. The purchasers agree to continue the business as heretofore, and to enlarge the plant and extend the system as rapidly as possible. The purchasers will organize and control a new corporation to operate the system.

ALAMOGORDO, N. MEX.—Bids are asked by the Board of Trustees of New Mexico Institute for Blind, at Alamogordo, until 10 a. m., Aug. 17, for construction of a steam heating plant and power-house for New Mexico Institute for Blind at Alamogordo. All materials and fittings to be furnished by successful bidder. R. H. Pierce is Secy. and Treas.

MERRITTON, ONT.—City has voted in favor of the by-law to purchase the local electric light plant, which is to be operated by the municipality, for $10,000.

PANAMA—See under U. S. Possessions.

BRIDGES.

*WOONSOCKET, R. I.—Bids are asked by Stephen Magown, Chn. Com. on Streets and Bridges, until 4 p. m., Aug. 21, for constructing a stone arch or a concrete and steel arch bridge on Sayles St., over the Blackstone River. Plans, specifications and form of proposal and contract may be obtained at the office of the City Engineer. Contractors may submit design and specification for a steel and concrete bridge. Frank H. Mills is City Engr.

BRIDGEPORT, CONN.—The Board of Apportionment has appropriated $250,000 for the Congress St. bridge and the New York, New Haven & Hartford R. R. Co. will pay $30,000 additional. M. W. Manwaring, Chn. Comm. R. M. Goddard is Engr.

BUFFALO, N. Y.—The New York Central & Hudson River R. R. Co., 335 Madison Ave., New York, has awarded the contract to JONES & LAUGHLIN, Third Ave. and Try St., Pittsburg, Pa., for a bridge at Barley Ave., Buffalo.

BUFFALO, N. Y.—The Lake Shore & Michigan Southern Ry. Co. will build three bridge structures on the Buffalo division this season, one at Athol Springs 1,560 ft. long, one at North Evans 850 ft. long, and the other at Irving 900 ft. in length, all to be of concrete and structural steel, constructed for four tracks, with all abutments, etc., of armored concrete. The work will be done by the company's construction department and not by contract. S. Rockwell is Ch. Engr. of Bridges and Roadway, Cleveland, Ohio, and will have supervision of the work.

COHOES, N. Y.—TUCKER & VINTON, 103 Park Ave., New York, have been awarded the contract for the construction of a 60-ft. reinforced-concrete bridge here for the New York Central & Hudson River R. R. Co.

ALBANY, N. Y.—For information concerning bridges to be constructed on the Barge Canal see "Barge Canal—Albany, N. Y." under Miscellaneous Contracts.

NEW YORK, N. Y.—Bids were received by James W. Stevenson, Comr. of Bridges on July 14 for the electrical equipment and the laying of sewers, water pipes and tracks and the grading and paving of the Plaza, in the Borough of Queens, of the Blackwell's Island bridge over the East River, between the Borroughs of Manhattan and Queens as follows: Hanover Construction Co., 129 West 125th St., New York, $215,940; McHarg, Bart & Co., 299 Broadway, New York, $218,780; Snare & Triest Co., 143 Liberty St., New York, $223,780; Cooper & Evans Co., 220 Broadway, New York, $209,135; Charles Meads & Co., 299 Broadway, New York, $182,200; Northeastern Construction Co., 225 Fifth Ave., New York, $194,344; James L. Carey, Brooklyn, N. Y., $236,381; Gore Engineering & Contracting Co., 206 Broadway, New York, $202,866; Long Island Contracting & Supply Co., New York, $203,029; Thomas Crimmins Contracting Co., 444 East 69th St., New York, $227,368; Astoria Paving Co., $251,052; Iron Slag Block Paving Co., $230,510; William G. Root, $223,896.

NEW YORK, N. Y.—Plans are being prepared by the Department of Bridges for the construction of the Hudson Memorial bridge across Spuyten Duyvil Creek, from Inwood to Spuyten Duyvil. The plans provide for a reinforced-concrete arch, 710 ft., with two roadways, to be built of reinforced concrete, steel and granite. Estimated cost, $3,000,000. John H. O'Brien is Comr. of Bridges.

LA SALLE, N. Y.—The Up-State Public Service Commission, Albany, N. Y., has ordered that a structural steel viaduct, with approaches, shall be erected at Hamilton St. here, south of Niagara Falls over the tracks of the New York Central R. R., Erie R. R. and the right-of-way of the Buffalo, Thousand Islands & Portland R. R., soon to be built, to eliminate grade crossing. Bids on material and construction will be called for as soon as plans can be prepared.

ALLENTOWN, PA.—Bids are asked until Aug. 12 by the County Commissioners, Allentown, for constructing a through-plate girder bridge with concrete encasements and reinforced-concrete floor over Mill Creek at New Smithsville, Weisenburg Township, Lehigh County, bridge to have a 40-ft. span. James S. Peter is Chn. Comrs.

NORRISTOWN, PA.—Bids are asked by the Commissioners of Montgomery County until 11 a. m., Aug. 26, for the construction of a highway bridge over Mill Creek, in Lower Merion Township. Plans may be examined at the office of Commissioners. Benjamin F. Penrose is Chn. Comrs. John H. Dager is Engr.

*PHILADELPHIA, PA.—Contracts for the construction of bridges were awarded on July 28 by George R. Stearns, Dir. Pub. Wks., as follows: Construction of the bridge on the line of Bellefield Ave., to the AMERICAN PAVING & CONSTRUCTION CO., 211 South Ninth St., at $49,446; for the erection of land piers for bridge over the Schuylkill River on the line of Passyunk Ave., to McGRAW & GRAY, Pennsylvania Bldg., at $57,105. List of bidders noted last week.

WILLIAMSPORT, MD.—Contracts for the construction of the steel and concrete bridge over the Potomac River at Williamsport have been awarded as follows by the directors of the Washington and Berkeley Bridge Co.: For the structural steel work, to the PENNSYLVANIA STEEL CO., of Steelton, Pa., at $30,000; for the concrete work, to EL-MORE & HAMILTON, of Hagerstown, Md., at $35,000. The piers and the abutments of the bridge will be built of solid concrete and the superstructure will be of steel. The bridge will be 1,600 ft. long and about 24 ft. wide, with accommodation for trolley-track, wagonway and a foot-path. The excavating and work on the piers will be commenced within 30 days. Mason R. Pratt is Engr.-in-Charge.

*ATLANTA, GA.—Bids are asked by D. Lee Wardroper, C. E., 810 Candler Bldg., Atlanta, until noon, Aug. 20, for the erection of a reinforced concrete viaduct on Ponce de Leon Ave., Druid Hills, Atlanta. The viaduct will be 126 ft. long, 61 ft. wide, and 30 ft. above the surface of the ground at highest point. Plans and specifications may be obtained from the Engineer.

WESTVILLE, MISS.—The Board of Supervisors of Simpson County has awarded contracts for constructing a steel bridge over the Strong River near Pinola and over the Pearl River at Mahoffy's Ferry to the CONVERSE BRIDGE CO., of Chattanooga, Tenn., at $4,283 and $8,362, respectively.

CHATTANOOGA, TENN.—The AMERICAN BRIDGE CO., 42 Broadway, New York, has been awarded a contract for, and started work on, the completion of a $65,000 steel truss bridge over the Chattanooga Creek.

SPRINGFIELD, OHIO.—Bids are asked until 2 p. m., Aug. 17, by the County Auditor for the sub and superstructure of the Greeting bridge in Pike Township.

WARREN, OHIO.—Bids are asked until Aug. 24 by the County Commissioners for the sub and superstructure of a bridge, 100 × 14 ft. over Mosquito Creek.

LAKEWOOD (Cleveland post-office), OHIO.—Bids are asked until 11 a. m., Aug. 17, by B. M. Cook, Village Clk., for furnishing the labor and materials necessary for constructing the substructure and superstructure complete for a steel foot bridge. The Wm. H. Evers Engineering Co. are Engrs., 237 The Arcade, Cleveland, Ohio.

DAYTON, OHIO.—E. M. GEPHART, of Dayton, has been awarded the contract at $150,963, for constructing the Dayton View bridge. Bids were opened on July 18.

CONNERSVILLE, IND.—The HACKEDORN CONTRACTING CO., of Indianapolis, Ind., has been awarded the contract for a 45-ft. reinforced concrete arch between Connersville and East Connersville, at $5,648. Other bidders were National Bridge Co., $3,835; King Bros. & Co., $6,344; Indiana Bridge Co., $4,998.

The contract for the approaches was awarded to KING BROS. & CO., at $10,008. Others bidders were J. H. Riley, $11,127; Hackedorn Contracting Co., $12,000.

CRAWFORDSVILLE, IND.—Bids are asked by the Board of Commissioners of Montgomery County until 11 a. m., Aug. 8, for the construction of a bridge in Wayne Township.

ECORSE, MICH.—F. J. MILLER, Detroit, Mich., has been awarded the contract, at $3,955, for constructing a steel bridge over the north branch of Ecorse Creek.

CHICAGO, ILL.—Bids are asked by the Department of Public Works, 200 Randolph St., until 11 a. m., Aug. 10, for the reinforcement and construction of the culvert over the intake slip of the Illinois and Michigan Canal, at S. Ashland Ave. John J. Hanberg is Comr.

PLATTSMOUTH, NEB.—Bids are asked until noon, Aug. 18, by W. E. Rosencrans, County Clk., for constructing a reinforced-concrete arch bridge and several reinforced-concrete culverts.

LINTON, N. DAK.—Bids are asked until Aug. 17, by J. G. Pitts, County Clk., for the construction of two steel bridges, one across Beaver Creek and the other across Beaver Creek between Sections 29 and 30.

GREAT FALLS, MONT.—The County Commissioners of Cascade County on July 27 decided to rebuild bridges as follows: Deep Creek, $10,000; Sun River at Great Falls, $8,000; Hound Creek, $4,000. B. D. Whitten is County Surv.

HELENA, MONT.—On July 22 the Lewis and Clark County Commissioners awarded the contract for constructing the two bridges over Prickly Pear Creek, near East Helena, to the MINNEAPOLIS STEEL & MACHINERY CO., Minneapolis, Minn., at $7,946. One bridge will be built over Prickly Pear Creek across Main St. and the other over a creek across Front St.

WAYNESVILLE, MO.—The County Court on July 25, awarded the contract for constructing two steel bridges in Pulaski County, one at the mouth of Bear Creek over the Gasconade River and the other at the Ross ford, over Piney River, to the CANTON BRIDGE CO., of Kansas City, Mo., at $6,526 and $4,275, respectively.

COLVILLE, WASH.—Bids are asked until 9 a. m., Aug. 24, by the County Commissioners for the construction of a bridge over Skookum Creek, near Lenora.

SPOKANE, WASH.—The plans and specifications of the City Engineer have been adopted by the Council, for the erection of new bridges at Oliver and Mission Ave., both structures will cost about $150,000; it is probable that the bridges will be built of reinforced concrete.

SUMNER, WASH.—S. H. WILLIAMS has been awarded the contract for constructing a bridge north of Sumner, over the Sumner River.

ASTORIA, ORE.—JOHN MATSON has been awarded the contract, at $5,429, for constructing a bridge over the Necanicum River.

COBOURG, ONT.—The Town Council contemplates erecting a number of concrete bridges to replace the wooden bridges within the town.

QUEBEC, QUE.—The Government has taken over the undertaking, assets, property and franchises of the Quebec Ry. & Bridge Co., and will build the Quebec bridge, which collapsed while under construction a year ago.

BUILDINGS.

(denotes that this work is advertised in Engineering News.)*

PORTLAND, ME.—Bids were received as follows July 30 by James Knox Taylor, Supervy. Arch., Treasury Dept., Washington, D. C., for the construction of a U. S. courthouse at Portland, Me.: Woodberry & Leighton, 166 Devonshire St., Boston, $169,838; F. W. Cunningham & Sons, Portland, Me., $177,428; W. F. Fissell & Co., New York, $171,300; Ambrose B. Stannard, New York, $178,000; Smith & Rumery, Portland, Me., $174,540; John Pierce Co., New York, $173,300; Conners Bros. Co., Lowell, Mass., $169,975.

BOSTON, MASS.—The contract for constructing an 11-story building at Washington Street and Temple Pl. has been let to the GEORGE B. H. MACOMBER CO., 16 State St., Boston. The building will have a frontage of about 96 ft. on Washington St. and 92 ft. on Temple Pl. On each floor the area will be about 8,700 sq. ft. The entire building will be of white glazed terra cotta. Arthur H. Bowditch, 7 Water St., is Arch. Estimated cost, $2,500,000.

HARTFORD, CONN.—Plans have been completed by Donn Barber, 24 East 23d St., New York, and E. T. Hapgood, 141 Trumbull St., Hartford, Archs., for a 3-story State library and supreme court building, at Hartford. Cost, $1,000,000. Morgan G. Bulkeley is Chn. Bldg. Com. L. W. Robinson, Secy.

BRIDGEPORT, CONN.—Bids are asked until 5 p. m., Aug. 10, by Joseph W. Northrup, Arch., Court Exchange, Bridgeport, for the construction of a 6-room addition to the Maplewood school.

PLAINVILLE, CONN.—The plans of W. P. Crabtree, Arch., of New Britain, for the proposed First National Bank building have been accepted. John H. Trumbull is Pres. of the bank. Contractors will be invited to submit proposals.

TORRINGTON, CONN.—The Board of Education has decided to erect a 12-room school building on East Main St., at a cost of about $45,000, and architects will be invited to submit plans and specifications. W. P. Norton is Chn. Bldg. Com.

NEW BRITAIN, CONN.—Bids are asked by the Charity Commissioners, until Aug. 7, for the construction of the new administration building at the town farm, after plans by Max Unkleback, Arch. The plans provide for 15 rooms in addition to the kitchen, laundry and wash room.

POUGHKEEPSIE, N. Y.—Bids are asked by T. E. McGarr, Secy. of State Lunacy Commission, until 3 p. m., Aug. 12, for furnishing and installing four horizontal tubular boilers at the Hudson River State Hospital, at Poughkeepsie, N. Y. F. B. Ware is State Arch.

OLEAN, N. Y.—The Knights of Columbus have awarded the contract for their proposed clubhouse to WILLIAM HENRY, of Bradford, Pa. Work will be commenced at once.

NEW YORK, N. Y.—The following bids were received on July 30 by the Park Board for furnishing all the labor and materials for the erection and completion of an administration building in the New York Zoological Park, in Bronx Park, in the City of New York: Kelly & Kelly, 43 East 42d St., $77,740; Guidone & Gilardi, 1 Madison Ave., $74,700; Clarke & Stowe, 41st St., near Second Ave., $84,900; F. T. Nesbit, 116 Nassau St., $79,000; J. H. Parker & Co., 225 Fourth Ave., $84,979; Fountain & Choate, 110 East 23d St., $78,986; H. Hollis Construction Co., $108,100; Wilmarth Bldg. Co., 1 Madison Ave., $78,400; J. McNally, 396 Broadway, $87,100; P. J. Brennan & Son, Fuller Bldg., $85,000; C. H. Peckwith, 83 Carmine St., $77,749; J. W. Schefer, Jr., 9 East 59th St., $73,328; R. E. Henningham, 1 Madison Ave., $81,778; J. F. Walsh & Bro., 136 Charlton St., $92,243; H. H. Vought & Co., Station Pl. and 210th St., $85,745; E. D. Broderick, 1382 Lexington Ave., $93,000; J. & L. Mooreland, 1710 Park Ave., $83,949; O'Connell & Hanna, 271 West 125th St., $73,998; Fleischman Bros. Co., 507 Fifth Ave., $89,450; J. J. Bush, 1904 Broadway, $81,950; Doe & Burgeson, 95 Liberty St., $81,950.

Bids are asked until 11 a. m., Aug. 20, by the Quartermaster, U. S. Marine Corps, Washington, D. C., for erecting a storehouse at the Marine Barracks, Navy Yard, New York. Bruce, Price & de Siboure, 527 Fifth Ave., New York, are Archs.

NEW YORK, N. Y.—Bids are asked until 10.30 a. m., Aug. 17, by Nicholas J. Hayes, Fire Comr., for additions and alterations to building of quarters of Engine Company 17, located at 91 Ludlow St.; for additions and alterations to quarters of Engine Company 37, located at 83 Lawrence st.; for additions and alterations to quarters of Engine Company 58, located at 81 West 115th St., and to quarters of Engine Company 35, located at 223 East 119th St.

Plans and specifications have been filed with the Department of Buildings by Oscar Hammerstein for the erection of a steel structure on the top of the Manhattan Opera House, 34th St. The stage will be 40 ft. deep and 80 ft. wide. For concerts a movable aluminum partition of shell shape will be used. The main part of the structure will be 50 ft. in height and the rear portion will be entirely open. In the winter the structure will be enclosed.

Alfred H. Taylor, Arch., 6 East 42d St., has let general contract to the WILLIAM L. CROW CONSTRUCTION CO., 289 Fourth Ave., for a 2-story bank building for the Union Dime Savings Institution. Cost, $225,000.

NEW YORK, N. Y.—Bids are asked by the Park Board until 3 p. m., Aug. 20, for work and material for the execution of the approach work exterior to the building of the New York Public Library, Astor, Lenox and Tilden foundations, Fifth Ave., 40th and 42d Sts. Henry Smith is Pres.

NEW YORK, N. Y.—The following bids were received on Aug. 4 by John V. Coggey, Comr. Dept. of Correction, for furnishing all the labor and materials required for repairs and alterations to City Prison, Borough of Brooklyn: George Syske, 1123 Broadway, $80,970; Jennings & Welstead, 227 West 50th St., $68,300; William Horn & Co., 17 West 132d St., $78,700; N. B. Smythe, 1123 Broadway, $80,400; Oromns & O'Brien, 900 President St., Brooklyn, $69,837; Joseph Bauer, 388 Wallabout St., Brooklyn, $74,468.

NEW YORK, N. Y.—The following bids were received on Aug. 4 by Nicholas J. Hayes, Fire Comr., for the erection and completion of a new building for Engine Company No. 206, on the westerly side of Broadway, 50 ft. north of Prospect St., West New Brighton, Boro. of Richmond: Charles Peckworth, 415 Hudson St., $27,690; W. H. Wright & Son, Valentine Ave. and 192d St., $24,900; Lawrence J. Rice, 7 East 42d St., $24,395; J. F. Walsh & Bros., 136 Charlton St., $29,477; Shern Const. Co., 271 W. 125th St., $24,000; Theo. Hilderbrand, 38 Park Row, $24,730; Richard Cornell, $26,500.

NEW YORK, N. Y.—Bids are asked until 10 a. m., Aug. 13, by Theodore A. Bingham, Police Comr., for installing heating systems in a number of police buildings in the city of New York.

PRINCETON, N. J.—Preliminary plans have been prepared by Frank Miles Day & Bro., Archs., 925 Chestnut St., Philadelphia, for a 3-story dormitory for the University of Princeton, at Princeton, donated by Mrs. Russell Sage. Cost, $250,000.

PITTSBURG, PA.—Thomas Hannah, Arch., Diamond Bank Bldg., advises us that bids will be received in about two weeks for a Y. M. C. A. building to be built here. The building will have five stories and will be 90 × 131 ft. It will be fireproof and of brick, stone and terra cotta. Bids will be received on general contract only. Cost, $250,000.

Lloyd Bros., Archs., Lewis Block, are preparing plans for a 2-story school building at Beltzhoover, for the Board of Education. The structure will cost $100,000.

BALTIMORE, MD.—CHARLES McCAUL CO., 613 American Bldg., Baltimore, has contract, at $124,337, for erection of addition to U. S. post-office.

WASHINGTON, D. C.—PAVARINI & WYNE, Munsey Bldg., have the contract, at $96,000, for the construction of the proposed assembly hall at the Government Hospital for the Insane.

ACCOMAC, VA.—Bids are asked until noon, Aug. 20, by the Supervisors of Accomac County for constructing a county jail. W. L. Nock is Chn. County Supervs. Frank P. Milburn & Co., Washington, D. C., are Archs.

HENDERSONVILLE, N. C.—H. S. Anderson has awarded contract to JOSEPH McCRARY, of Hendersonville, for erection of a tourist hotel in Columbia Park. The structure will have four stories, 150 rooms, steam heat, electric lighting, freight and passenger elevator and will cost $90,000. McCrary & Carter, Hendersonville, are Archs. Mr. Anderson will erect another hotel of similar construction, containing about 50 rooms, in Columbia Park.

AUGUSTA, GA.—We are officially advised that bids were received on July 28 by William N. Dunbar, Mayor, for erecting the proposed city hall. The building will be two stories high, 94 × 184 ft., of brick construction, with stone trimmings. Cost, about $150,000. L. F. Goodrich, 115 Eighth St., Augusta, is Arch. The contract has been let to T. O. BROWN & SON.

VALDOSTA, GA.—James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., has awarded contract for the construction of a post-office building at Valdosta, Ga., to the WILMARTH BUILDING CO., 1 Madison Ave., New York, at $100,045.

TUSCALOOSA, ALA.—James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., has awarded contract for construction of a post-office at Tuscaloosa, Ala., to the BLUE RIDGE CONSTRUCTION CO., Asheville, N. C., at $138,447.

KNOXVILLE, TENN.—Mowbray & Uffinger, Archs., 92 Liberty St., New York, N. Y., have let general contract to D. GETAZ & SONS, Knoxville, for a 1-story bank building for the City National Bank of Knoxville, Knoxville. Cost, $60,000.

MEMPHIS, TENN.—The Shelby County Court-house Commission, N. C. Perkins, Chn., has awarded contracts for interior fittings and furnishings for the proposed courthouse, as follows: Class 1, steel and iron work on interior, to VAN DORN IRON WORKS, 2685 East 79th St., Cleveland, Ohio, at $47,683. Class 5, interior marble work to JOHN PIERCE CO., Chicago, Ill., at $62,000. Class 6, electric and gas light fixtures, to BLACK & BOYD MFG. CO., 23 East 22d St., New York, at $18,887. The following contracts have not been awarded: Classes 2, 3 and 4, for electric time-clock system, watchman's time director system and fire-alarm system, for which one bid was submitted at $1,830. Class 9, for interlocking rubber tile flooring, etc., average bid being $10,729. Class 12, for lavatory appurtenances, for which one bid of $1,000 was submitted. Class 15, for portable fire extinguishers, which will not be awarded. Awards and those to be made call for expenditure of $188,461.

LISBON, OHIO.—Bids will be received by the Board of Commissioners of Columbiana County until noon, Aug. 17, for remodeling the county jail. C. H. Coburn is County Audr.

TOLEDO, OHIO.—B. F. Siebert, Arch., Mansfield, Ohio, has let general contract to the PERMANT CONSTRUCTION CO., 842 Nicholas Bldg., Toledo, for a 1-story concrete mausoleum, 30 × 85 ft., for the Toledo Mausoleum Co., 842 Nicholas Bldg., Toledo. Cost, $60,000.

CINCINNATI, OHIO.—Contract has been let by Des Jardins & Sheblessey to McMILLER & TAFT, 1308 Central Ave., for a 4-story school building for St. Bonaventura Congregation. Estimated cost, $75,000.

EAST LIVERPOOL, OHIO.—The contract for the erection of the steel and brick car barn that will be built here has been awarded to the GUY JOHNSTON CO., of Toronto, Ohio. The barn will be built for the Steubenville & East Liverpool Traction Co. Gould White, Engr.-in-Charge.

LAPORTE, IND.—We are officially advised that contracts have been let to E. BURNER & CO., of South Bend, Ind., for the construction of a county jail and sheriff's residence; and to SANBORN-MARSH ELECTRIC CO., 115 North Illinois St., Indianapolis, for the wiring, and the HUFFMAN-CONKLIN CO., Columbus, Ohio, for the heating plants at $60,000, $3,906 and $16,995, respectively.

INDIANAPOLIS, IND.—Bids are asked by Commissioners of Marion County until 10 a. m., Aug. 10, for the construction of an addition to the Marion County work-house. Albert Sahm is County Audr.

Bids are asked by Commissioners of Marion County until Aug. 19 for alterations in the court-house. Albert Sahm is County Audr.

The Commissioners of Marion County have ordered plans and will ask for bids soon for the construction of a new county asylum.

CLINTON, IND.—The Clinton Library Association, Dr. R. A. Adams, Pres., has ordered plans for the construction of a new Carnegie Library building. Bids will be in order soon.

LINTON, IND.—HUGO SCHLOOT has been awarded a contract to construct a Carnegie Library building in this city.

DETROIT, MICH.—Geo. L. Harvey, Arch., 210 Huron Ave., Port Huron, Mich., has let general contract to JAMES O'SULLIVAN & SON, Port Huron, for erecting a 2-story and basement stone and brick temple and office building, 42 × 81 ft., at 1207-1211 Woodward Ave., Detroit, for the Order of Gleaners, James Slocum, Mgr., Caro, Mich. Cost, $42,000.

BELLEVILLE, ILL.—Bids were received as follows July 24 at the office of the Supervising Architect of the Treasury, Washington, D. C., for the construction of a post-office at Belleville, Ill.: C. L. Gray Construction Co., St. Louis, $48,196; Hiram Lloyd Building & Construction Co., St. Louis, $50,989; Kellerman Construction Co., St. Louis, $51,-990; Globe Construction Co., St. Louis, $51,-800; General Construction Co., East St. Louis, Ill., $54,987; Barnes Bros., Hamilton, Ohio, $49,800; W. J. McAlpine, Dixon, Ill., $53,000; W. W. Luyster, Dayton, Ohio, $49,-670; S. L. Jones Building Co., St. Louis, $53,940; Charles Hoertz & Sons, Grand Rapids, Mich., $58,474; Bauer Bros., Belleville, Ill., $56,825.

ALTON, ILL.—Bids for the construction of the U. S. post-office at Alton, Ill., were received by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., on July 23, as follows: W. B. McAlpin, Dickson, Ill., $54,000, time as specified; Barnes Bros., Hamilton, Ohio, $53,300, Feb. 1, 1909; F. M. Rood & Co., Tifton, Ind., $54,470, time as specified; W. W. Luyster, Dayton, Ohio, $60,-000, time as specified; Globe Construction Co., St. Louis, Mo., $60,945, time as specified; C. L. Gray Construction Co., St. Louis, Mo., $53,534, time as specified; J. J. Weuilner & Son, Alton, Ill., $64,585, time as specified; Kellerman Construction Co., St. Louis, Mo., $65,000, time as specified; Hiram Lloyd Building & Construction Co., St. Louis, Mo., $56,738., time as specified; George Stagil, St. Louis, Mo., $75,000, time as specified; S. L. Jones Building Co., St. Louis, Mo., $56,940, time as specified.

CHICAGO, ILL.—D. H. Perkins, Arch., Board of Education, is preparing plans for a high school building to be built in South Chicago. The building will cost $500,000.

The following bids were received on July 26 by the Commissioner of Public Works for wrecking and caisson work for the proposed city hall: William J. Newman, $323,975, 260 days; John Griffiths & Son, $355,000, 195 days; George A. Fuller Co., $375,500, 215 days; George W. Jackson, Inc., $380,489, 180 days; B. M. Zadeck Co., $375,196, 200 days; George A. Fuller Co., $353,500, 315 days; Wells Bros. Co., $375,500, 270 days; William Krug & Son, $414,800, 252 days. Holabird & Roach, Monadnock Block, are Archs. Francis W. Taylor, Alderman, is Chn. Council Com. on City-hall.

MILWAUKEE, WIS.—Ferry & Clas, Archs., 419 Broadway, Milwaukee, have been selected to formulate the specifications for the addition which is to be made to the public museum. The specifications are to be completed by Sept. 20, and the building completed, it is estimated, will cost $285,000. It will be four stories high on the Eighth St. side, and will contain an auditorium with a capacity for seating 700 people. The addition is to be 250 ft. long by 80 ft. in width. Ground for the addition will be broken this fall, and the work of construction will be pushed as rapidly as possible.

WAUSAU, WIS.—Anton Dohmen, Arch., 290 Third Ave., Milwaukee, will prepare plans for a church for St. Stephen's Evangelical Congregation, Wausau, to cost $60,000.

BURLINGTON, IOWA.—We are officially advised that bids were received by D. S. Cooper, Secy. Bd. of Education, on July 30, for erecting a 2-story and basement high school building, 175 × 147 ft., for the Board of Education, Burlington. Temple, Burrows & McLane, McManus Bldg., Davenport, Iowa, are Archs. The contract has been let to W. M. ALLEN SONS CO., Peoria, Ill. Cost, $129,000.

IOWA CITY, IOWA.—The Board of Regents of the State University of Iowa has let contract to COLLINS BROS., Rock Island, Ill., at $102,490, for the erection of the law building. G. H. Ellsworth is Supt. Grounds and Bldgs. Proudfoot & Bird, Crocker Bldg., Des Moines, are Archs.

ST. PAUL, MINN.—An addition to the city-hall and court-house is contemplated. It will be built of cut stone, with steam heating and electric lighting. It will be of fireproof construction. E. G. Krahmer is County Audr. Cost, $800,000.

The contract for excavating the proposed Masonic Temple at Sixth St. and Smith Ave., St. Paul, has been awarded to J. H. NICKEL, 1036 Hague Ave. Cost, $125,000.

J. W. Stevens, Arch., New York Life Bldg., has awarded the contract for constructing the 6-story pressed brick and cut stone fireproof wholesale building for Noyes Bros. & Cutler, Sixth and Sibley Sts., to W. J. HOY & CO., 311 Chamber of Commerce. Cost, $60,000.

BUFFALO, MINN.—Thori, Alban & Fisher, Archs., Chamber of Commerce Bldg., St. Paul, have let general contract to BOERNER BROS., Buffalo, for erecting a 2-story high school building for the Board of Education. E. C. McGaffey, Clerk, Buffalo. Cost, $44,000.

MINNEAPOLIS, MINN.—Thori, Alban & Fisher, Archs., Chamber of Commerce Bldg., St. Paul, are preparing plans for the superstructure of a 2-story and basement hospital building for the Norwegian Lutheran Deaconess Hospital, Rev. I. Tollefsen. Cost, $60,000.

Plans have been completed by E. H. Hewitt, Arch., for the superstructure of a 2-story church for St. Mark's Episcopal Congregation, Rev. C. E. Haupt, Rector. The church will cost $150,000.

TOPEKA, KAN.—The general contract has been let by Howe, Hoit & Cutler, 315 East Tenth St., Kansas City, Mo., to the HOLLINGER CONSTRUCTION CO., Kansas City, Mo., for a 4-story hospital building to be built at Topeka for St. Francis Hospital and Sisters of Charity, Leavenworth, Kan. Cost, $50,000.

McCOOK, NEB.—Carl Boller, Arch., Kansas City, is preparing plans for a 3-story Masonic hall and theatre for Masonic Lodge, No. 135, Lew Carn, Secy., McCook. Cost, $40,000.

*CAPE GIRARDEAU, MO.—Bids are asked by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p. m., Sept. 30, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. post-office and court-house at Cape Girardeau.

ST. LOUIS, MO.—Plans have been prepared by Milligan & Wray, Archs., 721 Olive St., for an insane asylum for the Board of Public Improvements, A. J. O'Reilly, Pres. The structure will cost $800,000.

J. H. Lynch, Arch., Dolph Bldg., has let general contract to R. A. ANDERSON for a 2-story home for the Blind Girls' Home. Cost, $50,000.

Bids are asked by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p. m. Sept. 14 for the construction (including plumbing and gas piping) for the U. S. post-office in St. Louis Mo.

HOUSTON, TEX.—James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., has awarded contract for the construction of a post-office building at Houston, Tex., to JAMES A. McGONIGLE, of Leavenworth, Kan., at $359,443. Time, July 1, 1909.

SEATTLE, WASH.—Sparkman & McLean, 1124 First St., are considering plans for a 6-story hotel which they will build on the lot north of the Washington Securities Bldg. at Fifth Ave. and Union St. The structure will cost about $65,000.

The School Board has let the contract for the Jefferson high school to the ANDERSON POWER CO. for $189,850. Work on this structure will be begun at once. The site, on Queen Anne Hill, between Highland Pl., Galer and Lee Sts., is ready for excavation work and the building will be completed in one year. Equipment and other extras will bring the cost of the school to $250,000.

TORONTO, ONT.—Michael Shea, proprietor of Shea's Theater, Buffalo, N. Y., will erect a fireproof theater building in this city of steel and concrete construction, with pressed brick walls and terra cotta trimmings, at a cost of $300,000. Leon Lempert & Son, Archs., Cutter Bldg., Rochester, N. Y., are preparing the plans, which call for a building 92x168 ft., with a seating capacity of 2,500.

WINNIPEG, MAN.—The School Board has let a contract to the CARTER-HALLS-ALDINGER CO., Winnipeg and Chicago, at $59,-000, for a school-house in the suburb of Elmwood. Several other schools will be erected this year. R. H. Smith is Secy.-Treas.

EDMONTON, ALTA.—R. J. MANSON has the contract for the proposed court-house to be erected here. Cost, $165,000.

WATER SUPPLY—IRRIGATION.

(denotes that this work is advertised in Engineering News.)*

*BRANDON, VT.—Bids are asked by Fire District No. 1, until Aug. 18, at the office of the Brandon National Bank, for the construction of a system of water-works here. B. W. Howland is Chn. Com.

MANCHESTER, MASS.—Bids were opened as follows on July 23 by the city for laying three miles of water pipe: John McCourt & Co., Boston, Mass., $17,713; C. H. TAYLOR, Wellesley, Mass., $20,265 (awarded contract); P. F. Donovan, Boston, $20,519; Hanscom Co., Boston, $21,174; Frank Williams Co., Boston, $21,233; A. G. Tommasello, Boston, $21,852; Loring N. Farnum Co., Boston, $22,750; A. De Marco, Boston, $23,764; F. Cowin & Co., Boston, $23,812; Burnham & Poor, Andover, Mass., $24,320; Morley & Flatley, Manchester, $25,249; C. E. Trumbull Co., Boston, $25,703; D. Linehan & Son, Beverly, Mass., $27,431; Bruno & Pettite, Boston, $27,840. Raymond C. Allen, Manchester, is Engr.

SPRINGFIELD, MASS.—The contract for laying a 6-in. water main has been awarded to the HITCHCOCK SUPPLY CO. by the Board of Water Commissioners.

ALBANY, N. Y.—See "Barge Canal—Albany, N. Y." item under Miscellaneous Contracts.

BRUNSWICK, N. Y.—The Council has awarded to the SPECIALTY CONSTRUCTION CO., of Norfolk, Va., the contract for the construction of a water-works plant at about $11,448. The contract includes laying mains, erection of fire plugs and tank and all material and labor.

*WARWICK, N. Y.—The contract for constructing a storage reservoir, bids opened July 21, has been awarded to P. P. OHEHIR, of Warwick, at $20,408. The work includes 19,000 cu. yds. of excavation, 1,467 cu. yds. of concrete, four acres of clearing and grubbing, 110 cu. yds. puddling, 2,300 sq. yds. of paving and 120 ft. of 20-in. pipe, valves, etc.

*PEEKSKILL, N. Y.—Bids are asked by the Board of Water Commissioners until 8 p. m., Aug. 25, for the construction of water filters, pure water reservoir and appurtenances. Plans may be seen and specifications may be obtained after Aug. 10 at the office of I. W. Reynolds, City Engr., Peekskill, and at the office of Hazen & Whipple, Consulting Engrs., 103 Park Ave., New York. The work comprises about 13,500 cu. yds. of excavation; 4,500 cu. yds. of concrete; 4,700 cu. yds. of filter sand; 1,100 cu. yds. of filter gravel; pipes and appurtenances.

COHOES, N. Y.—We are officially advised that the contract for repairing the walls on No. 3 reservoir has been let to the GRATTON CONSTRUCTION CO., at $2.20 per sq. yd. for new stone, and $1.97 for old stone relaying. George Bolton is Design. Engr.

BUFFALO, N. Y.—All action taken by the Council in authorizing the Commissioner of Public Works to contract for furnishing and constructing a valve system at $174,700 was rejected on July 23, and it was decided that the old system should be repaired without the expense of erecting another building.

Bids were opened by F. G. Ward, Comr. Pub. Wks., on July 21, for the construction of the north boiler house at the pumping station. B. I. CROOKER & CO. submitted the lowest bid and have been awarded the contract at $40,048.

The contract for building the radial brick chimney at the pumping station was let to the ALPHONS CUSODIS CHIMNEY CONSTRUCTION CO., of New York, at $13,585.

*BELVIDERE, N. J.—Bids are asked by the Buckhorn Springs Water Co., Belvidere, for hauling, laying, joining, digging trench and covering 30,000 ft. of water pipe here.

WASHINGTON, D. C.—Bids were received as follows on Aug. 1, at the office of the Commissioners of the District of Columbia for furnishing 252 tons of c.-i. specials: Lynchburg Foundry Co., Lynchburg, Va., $46 per ton; United States C.-I. Pipe & Foundry Co., Philadelphia, $51.20; James B. Clow, Chicago, Ill., $54.88; M. J. Drummond, New York, $52.60; Central Metal & Supply Co., Baltimore, Md., $64.40.

BENETTSVILLE, S. C.—The city has awarded the contract to ABEE & EDWARDS, Hickory, N. C., at about $27,000 for constructing water-works here, including 5.75 miles of c.-i. water pipe, ranging in size from 4 to 10 ins.; tower and elevated tank 180 ft. high, with a capacity of about 100,000 gallons; several wells from 80 to 100 ft. deep. Bandy & Myers, Greensboro, N. C., are Engrs.-in-Charge; Hugh L. McCall is Chn. Bd. Pub. Wks.

JASPER, FLA.—The Jasper Water & Light Co. has been incorporated with $25,000 capital stock; W. A. Smith is Pres.; C. W. Smith is Vice-Pres.; B. B. Blackwell is Secy.-Treas.

FT. BARRANCAS, FLA.—Bids are asked in triplicate by Capt. D. W. Hand, Constructing Q. M., U. S. A., until 11 a. m., Aug. 29, for the construction of a steel trestle and water tank, or for moving and rebuilding old trestle and constructing new tank.

FORT TAYLOR (Key West post-office), FLA.—The contract for water proofing and repairing nine cisterns at Fort Taylor, Fla., has been awarded to FERGUSON & WARD, of Tampa, Fla., at $4,690.

CLOVERDALE, ALA.—The Cloverdals Homes & Improvement Corporation, O. O. Nelson, Mgr., contemplates laying 3,000 ft. of 8-in. water pipe and 7,000 ft. of 6-in. water pipe, to furnish Cloverdale with water.

CLARKSDALE, MISS.—Bids are asked by the Board of Aldermen until Aug. 24, for constructing a 250,000-gal. reservoir, reinforced concrete connected to a 4-valve or Corliss engine. For specifications address Walter G. Kirkpatrick, Engineer, Jackson, Miss.

MARTINS FERRY, OHIO.—The Board of Public Service has awarded the contract for furnishing suction pipe for the new water well system that is being installed here to the McWAIN CO., of Lynchburg, Va. The contract will amount to about $5,000.

*TOLEDO, OHIO.—Bids are asked by the Board of Public Service until noon, Aug. 25, for the construction of sections Nos. 1, 3 and 4 of the filtered water conduit. Reynold Voit is Secy. Bd.

NEWTON FALLS, OHIO.—Bids are asked by the Board of Public Service until noon, Aug. 10, for a steel water tower and tank having a capacity of 60,000 gallons. Carl W. Smith is Clk Bd.

*ROCKVILLE, IND.—Bids are asked until 2 p. m., Aug. 24, by the town for the construction of water-works. The plant will include brick pumping station, two vertical boilers, two horizontal duplex pumps of a capacity of 170 gallons per min. each, and about 2½ miles of 6-in. or 8-in. c.-i. pipe. Intending bidders may obtain plans and specifications at the office of F. E. Strouse, Town Engr., Rockville, Ind., or at the office of Dabney H. Maury, Consulting Engr., Peoria, Ill.

EVANSVILLE, IND.—Bids are asked until 7 p. m., Sept. 24, by the Board of Trustees of the Department of Water-Works for the construction of a mechanical filtration plant, consisting of stable foundations, coagulating basins of not less than 2,500,000 gallons capacity, twelve filter units of not less than 1,000,000 gallons daily capacity each, and a clear water basin of not less than 1,500,000 gallons capacity, together with suitable buildings, chemical storage, necessary machinery and equipment, all to be built immediately north of the present pumping station at Evansville, on lands now owned by the city. Surveys and borings are now being made of the underlying material on the site, which information will be placed at the disposal of the bidder, together with such other data as is deemed necessary or desirable. The city of Evansville, however, expressly stipulates that it does not in any way guarantee the accuracy of such information. Specifications containing general requirements and sketch plans of preferred arrangement can be obtained by intending bidders on or about Aug. 7 at the office of the Department of Water-Works, City Hall, Evansville. Bids will be received for the complete plant only. W. M. Madden is Clk. Bd.

*WINNETKA, ILL.—Bids are asked by the Village Board, until 8 p. m., ... 1, for furnishing materials and appliances and constructing a mechanical water filtration plant for purifying the water supply. ... plant include filters of 1,000,000 gallons ... per day, coagulated basins, clear-water ... capacity ervoir and the building for housing ... Reinforced concrete is required ... the construction where practicable. ... Alvord and Charles B. Burdick, ... W. ford Bldg., Chicago, Ill., are ... Hartiam B. McIlvaine is Village Pres.

FRANKLIN PARK, ILL.—Bids ... asked by the Village Clerk until Aug. ... for the construction of a reinforced-concrete ... reservoir of 100,000 gallons capacity ... tower and tank of 55,000 gallons capa... Emerson, 138 Washington St., Ch... Ill., is Engr.

CHADWICK, ILL.—BALLIS & ... of Oregon, Ill., have been awarded ... contract for the extension of water mains ...

NORTH CHICAGO, ILL.—The ... of Navigation, Navy Department, W... ton, D. C., has awarded the contract ... the construction of the heating and ... rical distributing mains and concrete ... at the Naval Training Station, Great Lakes, North Chicago, to W. H. SCHOTT, American Trust Bldg., Chicago, Ill., at $124,1...

*NEW BOSTON, ILL.—Bids were received by the Commissioners of the Bay ... Island Drainage and Levee District on July ... for the construction of a pumping plant, etc. The Commissioners adjourned without action until Aug. 15. There were between 25 and 30 bidders on the various portions of the work.

MILWAUKEE, WIS.—R. J. HICKEY has been awarded the contract, at $10,2..., for laying water mains to the county buildings at Wauwatosa. F. O. Phelps is County Clk.

HOSPERS, IOWA.—Bids are asked until 8 p. m., Aug. 20, by Joseph Klein, Town Clk., for the labor and materials for constructing water-works here.

CHARTER OAK, IOWA.—The SOUTH DAKOTA CONCRETE CONSTRUCTION CO., Rapid City, S. Dak., has secured the contract for the extension of water mains and the erection of a reinforced-concrete tank and reservoir.

BUHL, MINN.—Bids were opened at the office of M. A. Nichols, Village Recdr., on July 21 on changes and improvements to water-works and electric light plant, consisting approximately of 75-KW., 220-volt, direct-current, direct-connected dynamo, with 3-wire compensator set, or instead a 3-wire dynamo, switchboard, two 150-HP. high pressure boilers; 125-HP. high or medium-speed automatic engine, surface condenser, boiler-feed pump, closed heater and piping, all installed complete; also a brick building, 48 × 73 ft. The contract has been awarded to the R. B. WHITAERET CO., of St. Paul, Minn., at $22,023. Oscar Claussen, German-American Bank Bldg., St. Paul, is Engr.

DALLAS, TEX.—The city has appropriated $60,000 for the extension of water mains, of which sum $35,000 will be expended at once. J. B. Winslett is City Secy.

TEAGUE, TEX.—The city has awarded the contract to J. W. MAXCY & CO., Houston, Tex., for constructing a water-works system here.

ALTA LOMA, TEX.—We are officially advised that bids have been opened as follows for an air lift pumping station for the Galveston Water-Works: Collins, Bros., Houston, Tex., Ingersoll-Rand Co., $25,755; A. M. Lockett & Co., New Orleans, La., Laidlaw-Dun-Gordon Co., $26,000; Joseph L. Sweigard & Co., Philadelphia, Pa., Joseph L. Sweigard & Co., $25,648; L. H. Coley, Houston, Ingersoll-Rand Co., $24,434.

TULSA, OKLA.—Bids are asked by O. P. Jones, City Clk., until 6 p. m., Aug. 17, for the construction of a clarification basin for the water-works plant. T. C. Hughes is City Engr.

CHEHALIS, WASH.—Bids are asked by W. A. Westover, City Clk., until Aug. 17, for furnishing the material and constructing a gravity water supply system. G. N. Miller, Burke Bldg., Seattle, is Engr.

LOS ANGELES, CAL.—Bids are asked until noon, Aug. 15, by E. W. Moore, Treas. Pacific Branch, N. H. D. V. S., Soldiers' Home, Los Angeles County, for sinking a 12-in. well for water development.

SAN FRANCISCO, CAL.—The construction of the new water supply system for the Presidio has been indefinitely posponed, the War Department ordering that all bids for the construction of the new water plant to be put up at Point Lobos Creek be canceled. The Department gave as a reason "no funds available." The new plant was to have cost $120,000.

OGDEN, UTAH.—The city contemplates purchasing the water-works system and extending and improving the plant. A. F. Parker is City Engr.

TORONTO, ONT.—Hazen & Whipple, Consulting Engrs., New York, N. Y., have been retained to prepare plans and specifications for purification works, and as consulting engineers on their construction. An appropriation of $750,000 has been made for the plant.

SEWERAGE.

PORTLAND, ME.—The following bids were received on July 15 by Bion Bradbury, Comr. Pub. Wks., for constructing two sections of the Morrills Corner sewer: Section 1, John W. Gulliver, $19,224; Forgione & Romano Co., $12,290; R. D. Shanahan & Co., $9,410; J. J. Mahoney, $17,836; Section 2, John W. Gulliver, $5,951; Forgione & Romano Co., $4,312; R. D. Shanahan & Co., $3,128; J. J. Mahoney, $4,575.

NEW BRITAIN, CONN.—The Board of Sewer Commissioners has recommended to the Court of Common Council an extension of the East Trunk Line sanitary sewer from the sewer beds to a point near Linden St., a distance of about 8,900 lin. ft. Estimated cost, about $31,000.

CORTLAND, N. Y.—The Board of Public Works has ordered new sewers constructed at a cost of $4,000.

LANCASTER, N. Y.—The Lancaster Sewer Commission on July 29 awarded the contract for the construction of the sewer and for the disposal plant to DOMINICK PERSONA, of Niagara Falls, N. Y., at $75,-000. The disposal plant was let to A. L. COLLEY, of Binghamton, N. Y., at $24,000.

MOORESTOWN, N. Y.—Bids are asked until 8 p. m., Aug. 13, by the Township Committee, Township of Chester, Burlington County, at the Town Hall, Moorestown, for furnishing in carload lots and delivering along the line of sewer trench in Moorestown and vicinity about 4,136 ft. of 6-in. best quality salt glazed vitrified stoneware sewer pipe, deep and wide sockets and 10-in. × 4-in. "Y" branches; also about 1,204 ft. of 8-in. pipe same quality as 10-in., and 287-8-in. × 4-in. "Y" branches. Bidders must procure specifications from Charles Lassle, Township Clk., Moorestown, N. J., and inspect plans at the office of Earl Johnson, C. E., Township Engr., 301 Market St., Camden, N. J.

SYRACUSE, N. Y.—Bids were received as follows on July 23 by the Intercepting Sewer Board for the Improvement of Onondaga Creek, the improvement being part of the general plan for the intercepting sewer system: READ, CODDINGTON ENGINEERING CO., Niagara Falls, N. Y., $219,972 (awarded contract); W. J. Burns Co., $253,-608. Itemized bids are given this week under Contract Prices. Henry C. Allen is City Engr.

*RYE, N. Y.—G. Everett Hill, Vice-Pres. City Wastes Disposal Co., makes the following announcement: "A report has come to my notice stating that I advised the Village of Rye, N. Y., to pay royalty for the use of the septic tank process. This report, which I find was circulated by a competitor, is false. A license was offered to the Village of Rye for $1,500. I advised that the offer be declined. Those interested are referred to Justus A. B. Cowles, Pres. of the Village of Rye."

BUFFALO, N. Y.—Bids are asked until 11 a. m., Aug. 14, by the Department of Public Works, for the construction of sewers in several streets. F. G. Ward is Comr.

*CANAJOHARIE, N. Y.—Bids are asked by the Board of Trustees until 3 p. m., Aug. 17, for constructing storm drains or sewers. Robert A. Probst is Pres. Bd.

BUTLER, PA.—The Mayor has approved the resolution of Council selecting F. G. Ross, Farmers' Bank Bldg., Pittsburg, to prepare the plans for the construction of a sewage disposal plant and to have charge of the construction of this plant. Work will be started this summer.

DERRY, PA.—The Councils have awarded the contract for the construction of a sanitary sewerage system to the THOMAS SWEENEY CO., 4906 Cypress St., Pittsburg, at $24,000.

The contract for the construction of the sewage disposal plant that will be used in connection with this sewage system, was awarded to the C. S. LAMBIE COMPANY, 331 Fourth Ave., Pittsburg, at $16,000. Neil & Gill, Greensburg, Pa., are Borough Engrs.

BEAVER FALLS, PA.—The LUCIUS CO., of this city, has been awarded the contract for laying a 6-in. pipe from the main sewer up side streets, alleys and to buildings. The prices are 53 cts. per ft. for the excavation and laying where it 5 ft. deep; 59 cts. where 6 ft. deep; 64 cts. where 7 ft.; 71 cts. where 8 ft.; 77 cts. where 9 ft.; 84 cts. where 10 ft.; 91 cts. where 11 ft. $1 where 12 ft.; $1.07 where 13 ft., and $1.17 where 14 ft. deep. The contract price for all Y's and T's is 35 cts. each and for all taps 90 cts. each.

*PHILADELPHIA, PA.—Contracts for the construction of sewers, bids for which were opened on July 24, have been awarded by George R. Stearns, Dir. Pub. Wks., as follows: Extension of Cresheim Creek sewer system, to ADOLPH JAFFOLA, at $30,000; extension of the Wissahickon high-level system, to the MILLARD CONSTRUCTION CO., at $79,000; extension of Rock Run sewer to ROBERT HIGGINS, at $54,000; extensions of Deveroux St. sewer to DAVID PEOPLES, Betz Bldg., at $65,000, and DANIEL S. BADER, at $62,000.

WASHINGTON, D. C.—Bids are asked until noon, Aug. 17, by the Commissioners of the District of Columbia for the construction of pipe sewers.

*PORTSMOUTH, VA.—We are officially advised that bids were received as follows on July 28 by the Sewerage Commission for constructing a sanitary sewerage system for the Fifth Ward. Atlas Construction & Engineering Co., Reading, Pa., $77,502; Bryan & Co., Jacksonville, Fla., $68,183; David Peoples, Betz Bldg., Philadelphia, Pa., $93,-950; Guild & Co., Chattanooga, Tenn., $87,-143; Burrus, Goodwyn & Robinson, Emporia, Va., $102,887. The committee recommended to the City Council that Bryan & Co., the lowest bidders, be awarded the contract. Bascom Sykes is City Engr.

WELDON, N. C.—Surveys are being made for the construction of a sewer and water system for this city. Estimated cost, $35,000. W. C. Riddick, C. E., Raleigh, N. C., is Engr.

*LOUISVILLE, KY.—The contract for the construction of Section "B" of the western outfall sewer has been awarded by the Sewerage Commission to M. O'HERRON & CO., First and McKean Sts., Pittsburg, Pa., at $25,000. J. B. F. Breed is Ch. Engr.

LEXINGTON, KY.—JOSEPH MELVIN, Lexington, has been awarded the contract at following prices for constructing the Woodland Ave. sewer: 8-in. pipe, 95 cts. per ft.; 5-in. pipe, 50 cts. per ft.; junctions, 50 cts. each; rock excavating, $3.50 per yd.; flush tank, $90; manhole, $30.

GALION, OHIO.—Plans are being prepared for the construction of a sewerage system and disposal plant. Estimated cost, about $78,000.

DAYTON, OHIO.—The Council has passed an ordinance providing for the construction of three brick and concrete trunk sewers. Estimated cost, $38,000.

SPRINGFIELD, OHIO.—The Board of Publice Service has awarded the following sewer contracts: Wittenberg and Jefferson St. sewer, to CHARLES BIRD, $3,431; Lowrey and Washington St. sewer, same, $3,280; Mulberry St. sewer, to DANIEL DOYLE, $594; North St., Center St. and Fisher St. sewers, HUONKER & WILLIAMS, $3,832; West Main St., CHARLES BIRD, $3,903; Columbia St., Plum St., Franklin, Jefferson, Deardorff and Washington Sts., CHARLES BIRD, $3,280.

EAST LIVERPOOL, OHIO.—Bids are asked by the Board of Public Service, A. S. Hughes, Clk., until noon, Aug. 17, for the construction of a 6-in. sanitary sewer with 4-in. lateral connections, manholes and tank in Morton St., and also for an 18-in. vitrified pipe storm sewer in Avondale St. Bids must be separate.

OXFORD, OHIO.—Bonds for $50,000 have been authorized for constructing a sewer system for this city. Alexander Potter, 143 Liberty St., New York, is Engr.

HARTWELL (Cincinnati post-office), OHIO.—Bonds for $35,000 have been voted for constructing a sewer system for this village.

YOUNGSTOWN, OHIO.—Bids are asked by the Board of Public Service, W. H. McMillin, Clk., until noon, Aug. 14, for constructing sewers in Cleveland St., between Hillman and Edwards Sts., Highview Ave., from Mahoning Ave. to the end of the street, and Whitney Ave., from Mahoning Ave. to the end of the street.

SHELBYVILLE, IND.—Riggs & Sherman, Toledo, Ohio, will prepare plans and specifications for a general sewer system for this city.

ELKHART, IND.—Bids are asked until Aug. 7 by the Board of Public Works for furnishing material and constructing a 20-in. sewer in a portion of Cassopolis St. either of double strength vitrified pipe or concrete sewer pipe. Ethan L. Arnold is Chn. Bd.

INDIANAPOLIS, IND.—The Board of Public Works has ordered plans and specifications for the St. Paul St. sewer, about 7 miles in length. Estimated cost, $125,000. Bids will be in order soon.

FLINT, MICH.—The contract for constructing 2,300 ft. of 30-in. concrete sewer has been awarded to A. P. SOUTHWORTH, Adrian, Mich.

THOMAS BERGIN, Flint, secured the contract for 1,138 ft. of 10-in., 782 ft. of 15-in. and 580 ft. of 8-in. vitrified rock sewer.

MILAN, MICH.—Bids for the construction of about 3,700 ft. of 24-in., 20-in. and 15-in. sewer pipe were opened on July 14 by W. P. Gregory, Village Clk. The contract was awarded to FRANK R. STONE, of Lima, Ohio.

RED JACKET, MICH.—PHIL SHERIDAN, Hancock, Mich., has been awarded the contract, at $5,112, for constructing a sewer in Spruce St.

MOUNT CARMEL, ILL.—Bids were opened as follows on July 28 by the city for the construction of sewers in sewer district No. 1: CRANE BROS., Carbondale, Ill., $16,482 (awarded contract); Chicago Drainage Construction Co., Chicago, Ill., $16,501; H. C. Gass, Belleville, Ill., $16,572; Newman Sewer Construction Co., Evansville, Ind., $16,615; Paul Chipman, Evansville, Ind., $16,624; Wolf Maupin & Curdie, Alton, Ill., $18,843.

SPENCER, IOWA.—Bids are asked until Aug. 7 by R. L. Taylor, City Clk. for constructing a 10-in. vitrified sewer in a portion of East Fourth St.

CARTHAGE, MO.—Bids are asked until Aug. 10, by F. B. Newton, City Engr., for the construction of a sewer and laterals in sewer district No. 6.

*DALHART, TEX.—Bids are asked by W. D. Wagner, Mayor, until 2 p. m., Aug. 18, for the construction of sanitary sewers.

GUTHRIE, OKLA.—W. W. POTTER has secured the contract at $5.40 per lin. ft. for constructing storm sewers in District No. 39.

BELLINGHAM, WASH.—The contract for the main trunk sewer on C St., from Holly to Laurel Sts., has been let to KNUTE SEUSET, at $22,970. Other bidders were: Riddle, Kavanagh & Hawkins, $23,377; Bellingham Construction Co., $24,070; M. J. Hickey, of Tacoma, $27,665; Pacific Contracting Co., $23,895.

SPOKANE, WASH.—J. A. CLARK was awarded the contract at $85,000 for the construction of the Fourth Ward trunk sewer, District No. 4, by the Board of Public Works, on July 23. The engineer's estimate was $80,640. Other bids were: Foster & Hindle, $86,500; Maylor & Norlin, $85,900; Lang & Smith, $85,300; James C. Broad, $109,-965; John Fife, $87,944; Julia V. Costello, $92,000.

EUGENE, ORE.—The ordinance for constructing a sewer in the alley between Second and Third Sts. and commencing on the west side of High St. and running east to the river, has been passed.

MONROVIA, CAL.—Olmstead & Gillelen, Consulting Engrs., Los Angeles, Cal., are preparing plans for a sewer system for this city. Estimated cost, $50,000.

SALT LAKE CITY, UTAH.—Bids are asked until 8 p. m., Aug. 14, by the Board of Public Works for constructing pipe sewers in sewer extension No. 200. Louis C. Kelsey is City Engr.

BRANTFORD, ONT.—Bids are asked by Samuel Suddaby, Chn. Bd. of Works, in care of the City Clerk, until noon, Aug. 17, for laying about 2,000 ft. of 12-in. sewer pipe, average cut 15 ft., and 750 ft. of 12-in. cast-iron pipe, including crossing of Grand River, average cut, 7 ft., these pipes to be furnished by the city; also construction of manholes. Plans and specifications may be seen and instructions to bidders and forms of tender obtained at the office of T. Harry Jones, City Engr.

GARBAGE DISPOSAL.

(denotes that this work is advertised in Engineering News.)*

BOSTON, MASS.—CHARLES BERMAN, of 184 Louden St., East Boston, has been awarded the contract at $12,500 per yr. to collect and remove ashes and dirt in East Boston for a period of two years.

RANKIN, PA.—All bids submitted for the erection on July 27 of a garbage furnace here were unsatisfactory. Four bids were submitted, ranging from $3,500 to $13,000. The Council will meet on Aug. 4 and the matter will again be discussed.

TARENTUM, PA.—Bids are asked until 2 p. m., Aug. 8, by W. A. Gibson, Boro. Secy., for the construction and erection of a garbage plant of 15 tons capacity and for the erection of a brick building to cover the plant. M. Burke is Chn. Health and Sewer Comn.

*YOUNGSTOWN, OHIO.—Copies of the ordinance authorizing and directing the Board of Public Health to contract for the collection and removal of garbage are on file at the office of Engineering News, New York. Also general plan. Bids are asked until Aug. 20. Dr. H. E. Welch is Health Officer.

MILWAUKEE, WIS.—The Common Council on July 20 passed an ordinance providing for the issue of $200,000 garbage bonds.

STREETS AND ROADS.

(denotes that this work is advertised in Engineering News.)*

HARTFORD, CONN.—The following contracts for road construction, bids for which were opened at the office of the State Highway Commissioner on July 29, have been awarded: Town of Orange, 12,770 lin. ft. of macadam-telford on the Milford Turnpike, to the B. D. PIERCE, JR., CO., Bridgeport, Conn., at $1.59 for macadam and $2.15 for telford. Other bidders were: A. Brazos & Sons, Middletown, Conn., $1.85 and $2.20; O. T. Benedict, Pittsfield, Mass., $1.99 and $2.59; Connecticut Contracting Co., Meriden, Conn., $2.15 and $2.80; E. N. Clarke, Milford, Conn., $2.39 and $3.34; F. Arrigoni & Bro., Durham, Conn., $1.64 and $2.10; Thomas Kearney, Meriden, $1.62 and $1.95 C. W. Tryon, Meriden, $1.86 and $2.36; C. W. Blakeslee & Sons, New Haven, Conn., $1.64 and $2.60. Town of Voluntown, two sections of graded road, aggregate length, 3,695 lin. ft., to AMOS BRIDGES' SONS, Hazardville, Conn., at $3,621. Other bidders were: A. Brazos & Sons, $3,800; Ahern Bros., Sterling, Conn., $12,516; T. H. Gill Co., Boston, Mass., $4,060. Town of Torrington, 8,078 lin. ft. of grading with hardening top, to DONAHUE BROS., Middletown, at $7,793. Other bidders were: Pierson Eng. & Construction Co., Bristol, Conn., $12,040; John Die Michiel & Bro., Torrington, Conn., $12,500; Thomas J. Allen, Westerly, R. I., $25,675; Joseph Mascetti, Torrington, $10,500; Lewis Loughi & Bro., Torrington, $17,886; T. F. Foley, South Norwalk, Conn., $16,500. Town of Bethany, 5,045 lin. ft. of gravel road, to E. G. PARDEE, Bethany, at 98 cts per lin. ft. Other bidders were: O. T. Benedict, Pittsfield, Mass., $1.55; A. Brazos & Sons, Middletown, $1.38; T. J. Allen, Westerly, R. I., $1.65; E. N. Clarke, Milford, $1.39; the B. D. Pierce, Jr., Co., Bridgeport, $1.39. Town of Chester, 8,056 lin. ft. of macadam on the Hartford-Saybrook Turnpike, to DONAHUE BROS., Middletown, at $1.34 per lin. ft. Other bidders were: O. T. Benedict, Pittsfield, Mass., $1.89; A. Brazos & Sons, Middletown, $1.39; Roger Kennedy, Middletown, $1.87; Thomas Kearney, Meriden, $1.45; F. Arrigoni & Bro., Durham, $1.62; Amos Bridges' Sons, Hazardville, $1.42; Lane Construction Co., Meriden, $1.69; B. D. Pierce, Jr., Co., Bridgeport, $1.34. City of Hartford, 2,100 lin. ft. of telford, 32 ft. wide on Asylum Ave., to THOMAS KEARNEY, Meriden, at $5.70 per lin. ft. There was one other bidder, The F. T. Ley Construction Co., Springfield, Mass., at $5.80 per lin ft.

HARTFORD, CONN.—Bids for the construction of state road work will be received at the office of the State Highway Commissioner, Capitol, until noon, Aug. 11, as follows: Town of Simsbury, 5,639 lin. ft. of macadam road, 1,920 lin. ft., retaining wall, and seven tile culverts ranging in size from 12-in. to 24-in.; city of New London, 7,315 lin. ft of macadam-telford on Jefferson Ave., with four 12-in. tile culverts; town of Avon, 5,645 lin. ft. of macadam with two 24-in. tile culverts; town of Windsor, two sections, aggregating 4,850 lin. ft. of macadam with one 15-in. tile culvert; town of Bristol, 1,500 lin. ft. of macadam.

NEW YORK, N. Y.—Bids were received as follows on July 28 by George Cromwell, Pres. Boro. of Richmond for (A) furnishing all the labor and materials required for regulating and repaving with vitrified brick pavement on a concrete foundation the gutters of Lafayette Ave., Sharp Ave., Elm St. and Maple Ave., from Richmond Terrace to Harrison Ave.; and also the gutters of Townsend Ave., from a point 290 ft. west of Bay St. to Centre St., together with all work incidental thereto; (B) furnishing all the labor and materials required for regulating and repaving with vitrified brick pavement on a concrete foundation the gutters of Prospect St., from Burger Ave. to Columbia St.; Britton St., from Broadway to end of street; South St., from Burger Ave. to Broadway; Van Pelt Ave., from Richmond Terrace to a point about 175 ft. south of the Staten Island Rapid Transit Railroad crossing, and Van Name Ave., from Richmond Terrace to the Staten Island Rapid Transit Railroad crossing, together with all work incidental thereto; (C) regulating and repaving with vitrified brick pavement on a concrete foundation the gutters of Second St., from Lafayette Ave. to Tysen St.; Fourth St., from Franklin Ave. to Clinton Ave., and Fifth St., from Westervelt Ave. to Jersey St., together with all work incidental thereto; (D) furnishing all the labor and materials required for regulating and repaving with vitrified brick pavement on a concrete foundation the gutters of Seventh Ave., from Westervelt Ave. to Jersey St.; Sixth Ave., from Westervelt Ave. to Jersey St.; Fifth Ave., from Sherman Ave. to Jersey St.; Third Ave., from Westervelt Ave. to the summit; Second Ave., from Westervelt Ave. to the summit; Second Ave., from Westervelt Ave. to the summit; First Ave., from Westervelt Ave. to Turnpike and Fort Place, from Daniel Low Terrace to Tompkins Ave., together with all work incidental thereto; (E) furnishing all the labor and materials required for regulating and repaving with vitrified brick pavement on a concrete foundation, the gutters of Grant St., from Van Duzer St. to St. Paul's Ave.; Clinton St., from Bay St. to St. Paul's Ave.; Elizabeth St., from Bay St. to Van Duzer St.; Wave St., from Bay St. to Sand St.; Sand St., from Bay St. to Richmond Road; Prospect St., from Bay St. to Richmond Road; Jackson St., from Beach St. to William St.; Union Place, from Beach St. to Bay St., and Osgood Ave., from a point about 300 ft. east of Richmond Road to Vanderbilt Ave., together with all work incidental thereto: Josephinson's Sons, 193 Broadway, West New Brighton (S. I.), N. Y., (A) $19,766, (B) $20,658, (C) $11,-022, (D) $22,175, (E) $20,327; Quinroy Construction Co., Port Richmond (S. I.), N. Y., (A) $20,390; (B) $21,860; Bonacct-Vincelli, Degraw Ave., Brooklyn, N. Y., (A) $17,439, (B) $18,642; (C) $9,867, (D) $19,731, (E) $18,422; Atlanta Contracting Co., 434 East 91st St., Brooklyn, (A) $21,595, (B) $22,-695, (C) $11,530, (D) $23,067, (E) $22,002; W. J. Quinlan, Port Richmond, (A) $15,622, (B) $17,506; John E. Donovan, 25 Morningside Road, Port Richmond, (A) $19,580, (B) $22,328, (C) $11,789, (D) $25,778, (E) $22,-212; Douglas & Hahn, 1967 Pitkin Ave., Brooklyn, (A) $19,352, (B) $20,633, (C) $10,-884, (D) $24,658, (E) $14,879; Thomas Carlin, Kent Ave., Brooklyn, (A) $19,786, (C) $11,110; John Farrell, 2139 Crotona Ave., Borough of The Bronx, N. Y., (C) $11,905, (D) $23,931.

BROOKLYN, N. Y.—HENRY J. MULLIN, Jamaica, L. I., has been awarded the contract, at $17,815, for regrading and macadamizing Metropolitan Ave., from Dry Harbor Road to Jamaica Ave., Jamaica, a distance of three miles.

BROOKLYN, N. Y.—Bids are asked until 11 a. m., Aug. 19, by Bird S. Coler, Pres. Boro. of Brooklyn, for regulating and repaving with granite iron slag and asphalt pavement on a concrete foundation, the roadways of various streets; also for furnishing and delivering 500 net tons of refined asphalt at the municipal asphalt plant, 69th St. and Gowanus Canal.

NEW YORK, N. Y.—Bids were received on July 21 by John Cloughen, Acting Pres. Boro. of Manhattan, for (a) maintaining the asphalt pavement on the following streets, where the original contracts have been abandoned, in the Borough of Manhattan, City of New York, 48,000 sq. yds. of asphalt paving and 500 sq. yds. of old stone pavement; (b) maintaining the asphalt pavement on the following streets where the original contracts have been abandoned, in the Borough of Manhattan, City of New York, 18,-700 sq. yds. of asphalt pavement, 500 sq. yds. of old stone pavement; (c) regulating and repaving with asphalt pavement on a concrete foundation the roadway of 26th St., from about 360 ft. east of the east house line of First Ave. to the bulkhead line of the East River; (d) regulating and repaving with granite block pavement on concrete foundation the roadway of 32d St., from First Ave. to the East River: Vulcanite Paving Co., 1170 Broadway, New York, (a) $64,055, (b) $25,086; Sicilian Asphalt Paving Co., 41 Park Row, New York, (a) $72,225, (b) $28,275, (c) $6,904; Uvalde Asphalt Paving Co., 1 Broadway, New York, (a) $72,250, (b) $28,300, (c) $7,717; Asphalt Construction Co., Madison Ave. and 137th St., New York, (b) $28,742; Barber Asphalt Paving Co., 114 Liberty St., (c) $6,922; Matthew Baird Contracting Co., 433 East 92d st., New York, (d) $5,672; Atlanta Contracting Co., 438 East 91st St., New York, (d) $5,072; Sheehan Contracting Co., 280 Broadway, New York (d) $5,902; J. A. Garrity, 261 West 139th St., New York, (d) $5,678; William J. Fitzgerald, 547 West 45th St., New York, (d) $5,640; John Farrell, 2105 Seventh Ave., New York, (d) $5,278.

WHITESTONE (L. I.), N. Y.—Contracts were awarded last week by the Realty Trust for the macadamizing of all streets and avenues in the new Malba development, on the Sound front of Whitestone. The new improvements will cost $100,000.

*MINEOLA (L. I.), N. Y.—Bids are asked by William H. Luyster, Clk. Bd. of Supervisors of Nassau County, until 10 a. m., Aug. 31, for the general improvement of Flower Hill Ave., from the Middle Neck Road to Sands Point Road, Port Washington. J. B. C. Mackey is Engr-in-Charge.

*SARANAC LAKE, N. Y.—Bids are asked until 8 p. m., Aug. 18, by the Village Board for furnishing material and laying vitrified block, macadam and brick pavements, resetting old curb, etc.

NEW YORK, N. Y.—Bids were received as follows on July 31 by John H. Ahearn, Pres. Boro. of Manhattan, for constructing sidewalks on various streets and avenues in the Borough of Manhattan: Atlanta Contracting Co., 230 East 42d St., $7,652; P. J. Duffy, $8,284; Dennis McCarthy, $8,000; Leary & Donelar, $12,218; Bart Dunn, 444 East 68th St., $10,157; P. J. Kane, 735 East 150th St., $8,187; Bonacci & Vencelli, Degraw Ave., Brooklyn, $9,742.

*WESTFIELD, N. J.—Bids are asked until 8.15 p. m., Aug. 27, by the Town Council for improving Broad St. and Westfield Ave., between Elm St. and North Ave., with vitrified brick pavement on a 6-in. concrete base, with necessary curbing and underdrains. Lloyd Thompson is Town Clk.

*NEWTON, N. J.—Bids were received as follows on July 31 by the Board of Chosen Freeholders for grading and macadamizing a section of public road in the townships of Frankford and Sandyston, near Branchville, in Sussex County, about 3¼ miles long: Orange County Road Construction Co., earth

excavation, cu. yd., 75 cts.; macadam, sq. yd., 80 cts.; lump sum road complete, including all wrought-iron sluice pipes, $48,650; Cotter & Bergen, earth excavation, 55 cts.; macadam, 55 cts.; lump sum road complete, including all wrought-iron sluice pipes, $36,879; William R. Moore, earth excavation, 80 cts.; macadam, 62 cts.; lump sum road complete, $43,623; Hinnaman & Spraul, earth excavation, 65 cts.; macadam, 70 cts.; lump sum, road complete, $38,842; Eugene Munson and Samuel Lewis, earth excavation, 45 cts.; macadam, 75 cts.; lump sum, road complete, $38,526; JOHN C. TIERNEY, Hoboken, N. J., earth excavation, 36 cts.; macadam, 64 cts.; lump sum, road complete, $32,079 (awarded contract); George M. Frech, earth excavation, 50 cts.; macadam, 59 cts.; lump sum, road complete, $34,668. A. H. Konkle is County Engr.

*RIVER VALE (Hillsdale post-office), N. J.—JOHN C. TIERNEY has been awarded the contract at $7,626 for macadamizing Leslie and Westwood Aves. E. C. Humphrey, Hackensack, N. J., bid $7,776 for this work. H. G. Hering, Jr., Hillsdale, is Engr.

ASBURY PARK, N. J.—Bids are asked by William H. Bannard, Chn. St. Com., of the Common Council until noon, Aug. 17, for furnishing and laying about 6,100 sq. yds. of vitrified paving blocks or creosoted wood paving blocks, or bitulithic or asphalt block, or granitoid, or imperial pavement, on Mattison Ave., from Main St. to Cookman Ave.; and Bond St., from Cookman Ave. to Summerfield Ave. William C. Burroughs is City Clk.

JOHNSTOWN, PA.—The contract for two miles of state macadamized road from Ohio St. up Constable Hollow has been awarded to SAUPP & DHREW, of Altoona, Pa., at about $16,000.

NEW BRIGHTON, PA.—MILLER BROS., of this city have been awarded the contracts for paving Fifth Ave., and for constructing a concrete retaining wall along the entire length of that street.

HOMESTEAD, PA.—Contracts for grading, curbing and paving 13 streets here with vitrified fire brick have been awarded to F. J. ERBECK, Pres. of Council, at a total cost of $110,000. Mr. Erbeck resigned his official position in order to receive the contract.

SHARON, PA.—PETER COOK & SON, of this city, have been awarded the contract for paving Broadway with vitrified fire brick.

SCOTTDALE, PA.—Council has passed an ordinance providing for a bond issue of $20,000, which will be used in grading and paving streets here.

BROWNSVILLE, PA.—The CROSSAN CONSTRUCTION CO., of this city, has been awarded the contract for the construction of one mile of state macadamized road, beginning at the city limits, and also the contract for repairing six miles of state road between here and Rice's Landing, this road having been torn up during the construction of the extension of the Pittsburg, Virginia & Charleston R. R.

CLEARFIELD, PA.—Bids are asked until Aug. 10 by the State Highway Department, Harrisburg, Pa., for constructing 14,875 ft. of road in Sandy Township, Clearfield County.

BALTIMORE, MD.—We are officially advised that the following contracts have been awarded by the city for street improvements: Elm Ave., bitulithic, to WARREN BROS., 608 Fidelity Bldg.; Caton Ave., granite block, to F. E. SCHNEIDER & CO., 332 Law Bldg.; Smallwood St., vitrified brick, to P. F. REDDINGTON & SONS.

FT. DUPONT (Delaware City post-office), MD.—Bids for constructing a shell road and for draining Finn's Point national cemetery were received by Capt. J. L. Knowlton, U. S. A., on July 17 as follows: Arthur B. Smith, Salem, N. J., oyster shell road, $3,480; draining cemetery, $1,148; H. C. Clark, Delaware City, Del., oyster shell road, $3,280; draining cemetery, $1,687; Joseph Anderson, Delaware City, Del., oyster shell road, $3,500; draining cemetery, $1,600.

WASHINGTON, D. C.—The following bids were opened by the Commissioners of the District of Columbia, Washington, on July 18, for grading, as follows: E. G. Gummell, Washington, D. C., grading, 33 cts. per cu. yd.; blue curbing, 22 cts.; granite curbing, 32 cts.; repaving, 32 cts.; vitrified block gutters, 40 cts. G. B. Mullin, Washington, D. C., grading, 54 cts.; blue curbing, 28 cts.; granite curbing, 38 cts.; repaving, 43 cts.; vitrified block gutters, 64 cts.

The Commissioners of the District of Columbia have awarded the following contracts: For asphalt block paving at about $40,000, to the WASHINGTON ASPHALT BLOCK & TILE CO., South Capitol and R Sts., Washington; for grading Albemarle St., 41st St., Rittenhouse St. and Western Ave., to G. B. MULLIN, 612 F St. N. W. Washington; for grading Minnesota Ave., to the WARREN F. BRENIZER CO., 63 R St. N. W., Washington; for grading Kearney St., to STUTLER & READY, 400 Fifth St. N. W., Washington.

ROANOKE, VA.—The Street Committee has recommended that J. Markley be awarded the contract at $7,335 for repaving Salem Ave., and at $6,250 for constructing granolithic sidewalks; R. M. Bibb at $12,119 for paving two blocks of Campbell Ave. W. B. Bates is City Engr.

RICHMOND, VA.—The City Council has appropriated $10,000 for opening and widening streets. Charles E. Bolling is City Engr.

KEYSER, W. VA.—The BROOKS CONSTRUCTION CO. has been awarded the contract, at $1.37 per sq. yd., for paving with brick.

HENDERSONVILLE, N. C.—The city has voted $18,000 of bonds for street improvements.

HUNTSVILLE, ALA.—W. A. SCHRIMSHER, of Huntsville, has been awarded the contract, at 90 cts. per yd., to reconstruct four miles of road in Madison County. Frank C. Love is Road Superv.

JACKSBORO, TENN.—Campbell County will construct a road from Lafollette to Newcomb, Tenn. Bids are asked until Aug. 15. R. B. Baird is Rd. Comr.

MEMPHIS, TENN.—W. F. Gill, Supt. of Shelby County Roads, has awarded the following contracts for road work: Fourth District, about 42 miles, to J. S. ROBINSON and A. H. RAMSEY, at $450 per mile for grading, surfacing and other work of rebuilding, and $75 per mile for repairs; eighth district, 40 miles, to C. W. STEWART, at $490 per mile for constructing and grading, and $70 per mile for repairs; ninth district, 54 miles, to J. W. STARK, at $465 per mile for new work and $45 per mile for repairs; eleventh district, 39 miles, to JAMES P. CALLIS, at $550 per mile for grading and $75 for repair work, $37.50 per 1,000 ft. for lumber used in culverts and 20 to 24 cts. per cu. yd. for extra dirt work; twelfth district, to PEARSON & SIMS, at $530 per mile for grading, $72.50 for repairing, $32.50 per 1,000 ft. for culvert lumber and 18 to 20 cts. per cu. yd. for excess dirt removed; 13th district, to W. A. GUMMER, at $545 per mile for grading, $75 per mile for repairing, $37.50 per 1,000 ft. for lumber and from 18 to 23 cts. per cu. yd. of dirt ordered removed by the Road Commissioners; 18th district, 38 miles, to J. HEISKELL WEATHERFORD, City Engr., at $445 per mile for grading, $60 for keeping in repair, $37.50 per 1,000 ft. for lumber used in culverts, and from 18 to 23 cts. per cu. yd. for extra dirt hauled; first district, about 65 miles, to M. L. THOMPSON, at $540.50 per mile for grading, $75 per mile for repairing, $35 per 1,000 ft. for lumber used in culvert work; and from 20 to 28 cts. for hauling extra dirt; second district, 59 miles, to J. J. CORBETT, at $397.40 for grading, $75 for repairing, $37.50 for lumber, and 17½ to 20 cts. for extra dirt; 17th district, 12 miles, to H. B. MASSEY, at $540 for grading, $74 for repairing, $37.50 for lumber, and 32 cts. for hauling; 19th district, 13 miles, to W. B. MYERS, at $440 for grading, $65 for repairing, $33.35 for lumber, and from 18 to 28 cts. for hauling extra dirt. All the bidders are from Memphis.

YOUNGSTOWN, OHIO.—The contract for paving Garlick St. has been awarded to CONNELLY & REESE, of this city.

MULLIN & CALDWELL, of this city, have secured the contract for paving Silver St., at $6,696, and for paving Marion Ave., at $8,284.

NEWPORT, IND.—GEORGE W. SYKES, Newport, Ind., has been awarded the contract for constructing the Ruddy road, at $3,600; the Reynolds road, at $4,900, and the Church road, at $3,600. H. T. Payne, County Audr.

FRANKFORT, IND.—The Board of Commissioners of Clinton County has awarded the contract to WM. J. NEES, at $12,109, for constructing four roads, and to KELLEHER, STEPHEN & BOLT for constructing one road, at $3,820. C. F. Cromwell is County Audr.

NEW ALBANY, IND.—Samuel T. Mann, City Engr., has prepared plans and specifications for improving portions of 15th and East Tenth Sts., by curbing, guttering and laying 6-ft. granitoid sidewalks.

LAPORTE, IND.—The Commissioners of Laporte County have awarded the contract to W. B. HUTCHINSON at $3,757, for constructing a macadam road in Michigan Township. Charles H. Miller is County Audr.

ANDERSON, IND.—The Commissioners of Madison County have let contracts for the construction of the following gravel roads: Walker road, No. 2, $3,657; No. 3, $4,076; No. 6, $3,837; Thurston road, $4,250; the Gosnel road No. 1 to J. B. Little, Indianapolis, $4,460; George Forey road, to VAN BUSKIRK BROS., Anderson, $3,000; Osborn road to J. D. REASON, $4,957; Cook road to FRANCIS HARLAN, $4,175; Hurst road to MADISON CONSTRUCTION CO., of Anderson, $5,489; Reeves road, to J. E. BURKE, Anderson, $4,660. There were 117 bids submitted.

TERRE HAUTE, IND.—Bids are asked by the Commissioners of Vigo County until Aug. 22, for the construction of 7,920 ft. of rock road. G. N. Wallace is County Audr.

MONTICELLO, IND.—The Commissioners of White County have awarded a contract to LOUIS T. KENT, of Brookston, Ind., for the construction of 8½ miles of gravel road, at $20,550.

BLUFFTON, IND.—The County Commissioners have let a contract to C. A. BRINNEMAN for the construction of 15,480 ft. of gravel roads.

DETROIT, MICH.—The Council has awarded contracts for paving with sheet asphalt, on a concrete foundation, as follows: To J. A. MERCIER, 210 Hammond Bldg.: Beech St., $3,986; Fifth St., $11,684; Orchard St., $3,095; Second Ave., $5,353; Spruce St., $5,001, and Scotten Ave., $6,629; to T. E. CURRIE, 17 Peninsular Savings Bank Bldg., Clinton Ave., $3,879, and Mullet St., $4,830.

FORT DODGE, IOWA.—ENGLE BROTHERS, of Fort Dodge, have been awarded the contract for the construction of combined concrete curb and gutter on both sides of First Ave. South, from Twelfth St. to 15th St., about 2,485 lin. ft. King E. Beal is City Clk.

*NORFOLK, NEB.—Bids are asked by Ed. Harter, City Clk., until 6 p. m., Aug. 25, for laying about six blocks of vitrified brick block pavement, according to the plans and specifications on file in the office of the City Clerk.

HOT SPRINGS, ARK.—Bids are asked by the city until Aug. 15 for various street improvements: F. V. P. Ellsworth is City Engr.

PALESTINE, TEX.—The city will expend about $50,000 for street paving.

TACOMA, WASH.—The contract for paving Pacific Ave., from South 17th St. to South 35th St. has been awarded to W. J. MURPHY, at $87,419, this bid being $15,000 under the City Engineer's estimate. From 17th St. south to 21st St. it is to be paved with brick; from 21st to 26th St. is now paved with asphalt on which there is a maintenance clause, and it will not be repaved at this time; from 26th St. to 34th St. is to be paved with sandstone blocks, and from 34th St. to 35th St. with brick. The Engineer's estimate was $102,515.

SEATTLE, WASH.—The Board of Public Works has awarded the following contracts for street improvements: 21st Ave. and East Olive St., asphalt paving, P. J. McHUGH, at $51,275; 16th Ave. North and other streets, asphalt paving, same, at $245,863; West Lee St. and other streets, asphalt paving, BARBER ASPHALT PAVING CO., Mutual Life Bldg., at $151,896; Eastlake Ave., asphalt and brick paving, F. McLELLAN & CO., Burke Block, at $114,357; Roy St. and other streets, asphalt paving, same, $178,417; 10th Ave. N. E., concrete walks, ANDREW PETERSON, at $4,265; West 73d St. and other streets, grading, SEATTLE GRADING CO., at $7,554; North and West 70th St. and other streets, grading, JOHN KALBERG, Seattle, at $18,480; Olive St. and other streets, regrade, HAWLEY & LANE, Fourth Ave. and Olive Sts., at $56,015.

MANUFACTURING PLANTS.

(denotes that this work is advertised in Engineering News.)*

FOXCROFT, ME.—The contract for the construction of a woolen mill for Mayo & Son at Foxcroft has been awarded to the EASTERN CONCRETE CO., of Boston, Mass. Work will begin at once, and it is expected that the building will be completed in November.

EAST WEYMOUTH, MASS.—The George E. Keith Co. will establish a plant in East Weymouth for making women's shoes. The factory, including the cost of the site, will be valued at about $40,000.

LYNN, MASS.—Henry W. Rogers, Arch., has prepared plans for an addition to the shoe factory for E. E. Strout.

MONSON, MASS.—The contract for the foundations of a new mill to be erected by A. D. Ellis has been awarded to JAMES HALE. The structure will be of brick and stone, 65 × 120 ft., three stories in height, together with an ell, 40 × 72 ft. The building will cost about $50,000 and when completed will be equipped with six full sets of modern machinery. Work on the foundations has been started and it is expected that the superstructure will be commenced in about three weeks.

HARTFORD, CONN.—A reorganization of the Pope Mfg. Co. has been effected. The new capitalization will be $2,500,000 of preferred stock and $4,000,000 of common stock. The new company will purchase the entire property and will operate the factories here and at Westfield, Mass.

SOUTH WINDHAM, CONN.—The Smith-Winchester Co. has awarded the contract for an addition to its plant to the BERLIN CONSTRUCTION CO., of Berlin, Conn., at a cost of about $40,000. The building will be of iron, brick and steel construction.

BINGHAMTON, N. Y.—T. I. Lacey & Son, Archs., have prepared plans for a 4-story brick factory building for Dunn & McCarthy.

SCHENECTADY, N. Y.—Peter Fuller & Sons, 47 Broadway, Schenectady, are having plans prepared for a 3-story flour mill, on Broadway, near Villa Road. Bids will soon be asked.

BROOKLYN, N. Y.—Three new factory buildings for the manufacture of moving picture films will be erected by the Vitagraph Company of America on its property at Elm Ave. and the Brighton Beach railroad. The new factories, like those at present occupied by the company, will be built of concrete blocks, and will cover the balance of the company's plot, building up the entire block. A building 80 × 100 ft. will be built on the southwest corner of the block. The other two buildings will be used as studios in arranging and staging smaller productions.

The walls and roof of the upper stories will be built of glass to provide ample light. One will be 40 × 70 ft., and the other 60 × 70 ft. in size, covering altogether a plot of nearly 50,000 sq. ft. Cost, about $50,000.

ALBANY, N. Y.—The sub-contract for the erection of the structural steel work for the $250,000 erecting shop to be constructed for the New York Central & Hudson River R. R. Co. at the West Albany yards has been awarded to the BROWN & KETCHAM IRON WORKS CO. The general contractor is L. B. Milliken, of Indianapolis, Ind. George W. Kittredge is Ch. Engr. of the railroad company.

NEWBURGH, N. Y.—Contract has been awarded to the CONCRETE-STEEL CO., 29 Broadway, New York, for a 2-story and basement addition to the bleachery buildings of Joseph Chadwick's Sons. Construction is to be of concrete and steel. The buildings will be 40 × 119 ft.

PATERSON, N. J.—We are officially advised that contract has been let by Harry E. Danner to FRANK B. GILBRETH, 34 West 28th St., New York, for a cotton mill which is to be erected at Paterson, N. J., at a cost of $100,000. Construction is to begin immediately.

PHILADELPHIA, PA.—C. E. Rahn, Arch., 410 Walnut St., Philadelphia, writes us that contract has been let to E. ELLIOTT, 1235 Brown St., Philadelphia, for constructing an addition, 28 × 40 ft., to the factory of William Frisien, 145 North Seventh St.

AVIS, PA.—The New York Central & Hudson River R. R. Co. has awarded contract to A. F. CHAPMAN & CO., 20 Breckenridge St., Buffalo, N. Y., for a brick and steel addition to round-house, at a cost of $50,000.

SHARON, PA.—We are officially advised that the WILLIAM B. SCAIFE & SONS, 221 First Ave., Pittsburg, Pa., has received contract for the steel frame building required for the extension to the plant of the Driggs-Seabury Ordnance Corporation, Sharon, Pa.

DOVER, DEL.—William H. Barnard has obtained a charter to buy, sell and deal in all fabrics and materials to be manufactured from flax, wool and other products. Capital stock, $1,000,000.

BALTIMORE, MD. — The STANDARD OVERALL CO., 413 West Pratt St., has awarded the contract to R. B. MASON, 1 West Biddie St., Baltimore, for the erection of a factory building, 35 × 125 ft., at Hill and Penn Sts. Noted on July 30.

The Vacuum Ice Co., 28-40 South St., has issued $80,000 of bonds for the construction of a vacuum system ice plant, with a capacity of 190 tons per day, to replace the present plant.

CLARKSBURG, W. VA.—The Parkersburg Sheet & Tinplate Co. will make extensive improvements to its plant.

MARTINSBURG, W. VA.—Benjamin F. Byers has established a factory for manufacturing canvas gloves.

MONROE, N. C.—The Heath Hardware Co., W. C. Wolfe, Mgr., has established a plant to manufacture concrete tiling, bricks and building blocks.

SALISBURY, N. C.—The Kesler Manufacturing Co., Salisbury, N. C., has completed arrangements for the installation of motors for 250 HP. and other electrical machinery in order to operate the plant by electricity. The company has an equipment of 27,000 spindles and 304 looms, manufacturing sheetings.

CHARLESTON, S. C.—The Charleston Paper Box Co., organized by W. S. Lammon and E. H. Schirmer, Jr.; will establish a plant for the manufacture of paper boxes. The building will be 2½ stories, frame, 40 × 100 ft., electric power, each machine to have an individual motor.

BON SECOUR, ALA.—The Strong Mill Co., recently incorporated, will establish a mill of 15,000 ft. daily capacity and will erect a sawmill and lumber sheds. C. A. Swift is Pres.; E. W. Strong is Vice-Pres. and Gen. Mgr.; G. R. Swift is Secy. and Treas.

BIRMINGHAM, ALA.—The Alabama Paper Box Mfg. Co. has been incorporated with $10,000 capital stock. C. C. Rhodes is Pres.; E. W. Brandon is Vice-Pres.; A. M. Rhodes is Secy.; John D. Elliott is Treas.

NEW ORLEANS, LA.—Daniel Schofield is planning to organize a company, with a capital stock of $250,000, to build a 15,000-spindle cotton mill, which will be operated by electricity.

HOPKINSVILLE, KY.—The Kentucky Glove Mfg. Co. has been incorporated by Abraham Meyers, Jacob Meyers and others.

DAKOTA, MINN.—Wm. H. Stevens, Arch., Winona, Minn., is preparing plans for a 1-story cold storage addition for W. H. Harrington, Dakota.

WICHITA, KAN.—F. F. Parsons, Arch., 341 Bitting Bldg., Wichita, is preparing plans for a 2-story and basement cold storage building, 51 × 125 ft., for C. W. Southward, to be of brick and stone construction, gravel roof, steel joist hangers, concrete floors, galv. iron skylight, hard plaster, gas and electric fixtures, water closets and lavatories. Cost, $10,000. The owner may be addressed.

HOUSTON, TEX.—W. H. Rogers, Birmingham, Ala., will establish a plant to manufacture paint.

FORT WORTH, TEX.—The Fort Worth Iron & Steel Co. has reorganized and incorporated with $160,000 capital stock as the Texas Rolling Mill Co. The plant, which has been closed, will be modernized and equipped to produce 100 tons of merchant bars daily, together with cotton ties and track spikes and bolts. George W. Armstrong is Pres.; W. H. Mills is Vice-Pres., both of Fort Worth; E. A. Hughes, Secy. and Mgr., St. Louis, Mo.

GEORGETOWN, COLO.—A mill with a capacity of about 10 tons daily is to be erected soon by the Capital Mining & Tunnel Co.

MISCELLANEOUS CONTRACTS.

U. S. RECLAMATION SERVICE.—Items regarding irrigation, canal projects, etc., will be found under Water Supply—Irrigation.

DRAIN.—Rockwell City, Iowa.—Bids are asked by B. E. Stonebraker, County Audr., until 1 p. m., Aug. 13, for constructing Drain No. 24.

DITCH.—Fort Wayne, Ind.—Bids are asked by David F. Spindler, Supt., until 2 p. m., Aug. 7, for the construction of the Trubenback Ditch in Washington Township.

*LUMBER AND STONE.—Charleston, S. C.—Bids are aksd until noon, Sept. 5, by Capt. R. M. Adams, Corps Engrs., U. S. A., for furnishing creosoted lumber and rubble stone.

DREDGING.—Oakland, Cal.—Bids are asked by Lt.-Col. John Biddle, Corps Engrs., U. S. A., Chronicle Bldg., San Francisco, Cal., until noon, Aug. 14, for dredging in Oakland Harbor.

CONDUIT.—Boston, Mass.—Bids are asked until noon, Aug. 10, by Guy C. Emerson, Supt. of Streets, Boston, for Stony Brook conduit in Meehan St. and Private land Section 5, West Roxbury.

PIERS.—Baltimore, Md.—Bids are asked until 11 a. m., Aug. 12, by the Superintendent of Harbor Board, Department of Public Improvements for construction of two pile and timber piers Nos. 7 and 8.

DREDGING.—Columbus, Ohio.—Bids are asked until noon, Aug. 11, by the State Board of Public Works, Columbus, for dredging the Northern Division of the Ohio Canal. Charles E. Perkins is Ch. Engr.

DITCH.—Frankfort, Ind.—Bids were received by Wm. A. Robison, Drainage Commissioner, on July 18 for construction of the Silas Williams Ditch, No. 715. Contract was let to CROMWELL YOUNG, of Frankfort.

METAL TREE GUARDS—New York, N. Y.—Bids are asked by the Department of Parks until 3 p. m., Aug. 13, for furnishing and delivering 500 expanded metal tree guards (No. 1, 1908) for parks, Boro. of the Bronx.

DRAINAGE.—Burlington, Iowa.—Contract has been awarded to JACOB HARMON, C. E., Peoria, Ill., for preliminary work in connection with the drainage project in south Louisa County and north Des Moines County.

*STONE.—New York, N. Y.—Bids are asked until noon, Aug. 22, by Col. John G. D. Knight, Corps Engrs., U. S. A., Army Bldg., New York, for furnishing and delivering paving stone for repairing Small Island Dike in Hudson River, N. Y.

DITCH.—Hampton, Iowa.—Contract for construction of Franklin County Ditch No. 3 has been let to the WEST BEND DRAINAGE CO., West Bend, Iowa, at 7⅝ cts. a cu. yd. Estimated quantity, 145,000 cu. yds. Geo. L. Mechem is Const. Engr., Clarion, Iowa.

DITCH.—Newcastle, Ind.—Bids were received by Nathan Nicholson, Drainage Comr., Henry County, on July 28, for construction of the John Adams Ditch. Contract has been awarded to GRANT DE WITT, Lewisville, Ind., at $3,848. C. Ratcliff is Engr., New Castle.

DRY DOCK.—Bremerton, Wash.—The Bureau of Yards and Docks, Navy Dept., Washington, has awarded contract for the construction of a concrete and granite dry dock at the Puget Sound Navy Yard, Bremerton, Wash, to C. J. ERICCSON, Seattle, Wash., at $1,625,000.

RUBBER HOSE.—New York, N. Y.—Bids are asked by Nicholas J. Hayes, Fire Comr., until 10 a. m., Aug. 12, for furnishing and delivering (a) $5,000 ft. of 3½-in. rubber fire hose for fireboats, Boro. Manhattan; and (b) for 2,500 ft. of 3½-in. rubber fire hose, Boro. Brooklyn.

*DREDGING.—Plymouth, Mass.—Bids are asked until 2 p. m., Sept. 4, by the Board of Harbor and Land Commissioners, State House, Boston, Mass., for dredging a channel in Plymouth harbor, from the Cow Yard to the wharf of the Plymouth Cordage Co. Frank W. Hodgdon is Ch. Engr.

AIR COMPRESSORS.—Washington, D. C.—Bids were received as follows July 31 at the office of the Public Printer, Washington, D. C., for two air compressors: Ingersoll-Rand Co., 11 Broadway, New York, $21,615. $18,783. Laidlaw-Dunn-Gordon Co., Philadelphia, $16,365, $15,590; $15,245.

ELEVATORS.—Huntington, W. Va.—Bids were received as follows on July 31 at the office of the Supervising Architect, Washington, D. C., for furnishing an elevator for the post-office building at Huntington; Otis Elevator Co., New York, $4,170; Brodessor Elevator Mfg. Co., Milwaukee, Wis., $4,294.

DITCHES.—Fulton, Ill.—Bids are asked until 2 p. m., Aug. 12, by the Commissioners of the Cattail Drainage District, Fulton, for the construction of the proposed ditches of said Drainage District, requiring the removal of approximately 300,158 cu. yds. of material. W. F. Sears, Prophetstown, Ill., is Engr.

DREDGING.—Philadelphia, Pa.—Bids were received on July 22 by the Fairmount Park Commissioners for dredging the Schuylkill River within the park limits. Contract was awarded to ROBERT PATTON, 21st and Filbert Sts., Philadelphia, at 45 cts. a cu. yd. Estimated cost, $5,000. Jesse T. Vogdes, Ch. Engr. and Supt.

DAMPPROOFING, ETC.—New York, N. Y.—The only bid received by John W. Brannan, Pres. Bd. Trustees, Bellevue and Allied Hospitals, on July 30, for dampproofing, etc., at Fordham Hospital, Crotona Ave. and the Southern Boulevard, New York, was submitted by Rubin Solomon & Son, Flatiron Bldg., New York, at $11,808.

*DREDGING.—Boston, Mass.—Bids were received on July 31 by the Board of Harbor and Land Commissioners, State House, for dredging an anchorage basin at Winthrop, Mass. Frank W. Hodgdon, Ch. Engr. Contract was awarded to BAY STATE DREDGING CO., 185 Summer St., Boston, at 24½ cts. per cu. yd. Estimated quantity, 20,000 cu. yds.

GRADE CROSSINGS.—Bristol, Conn.—The New York, New Haven & Hartford R. R. Co. will be given a hearing by the Railroad Commissioners at the Capitol, Hartford, Conn., on July 30, at 11 a. m., on its petition for the elimination of the grade crossings at Henry and East Sts., Bristol, Conn. This also includes the construction of a new highway.

BLOCK SIGNALS.—New York, N. Y.—Bids are asked by the Department of Bridges until 2 p. m., Aug. 11, for the construction of block signals for the elevated railway tracks of the Williamsburg (new East River) Bridge over the East River, between the Boroughs of Manhattan and Brooklyn. J. W. Stevenson, Comr. (See item giving bids received on July 30 for this contract.)

DREDGING.—Boston, Mass.—The following bids were received on July 31 by the Board of Harbor and Land Commissioners for dredging about 23,000 cu. yds. scow meas., in West Falmouth Harbor, Mass.: John H. Gerrish, 247 Atlantic Ave., Boston, 38 cts.; Cavanagh Bros., 471 Dorchester Ave., 38 cts. Totals, $8,740 each. Frank W. Hodgdon, Ch. Engr., State House, Boston.

*SEAWALL, ETC.—Fort Mason (San Francisco post-office), Cal.—Bids are asked by Maj. George McK. Williamson, Q. M., U. S. A., until noon, Aug. 25, for construction at Fort Mason, San Francisco, Cal., of a seawall, crib-wall, transport wharves and sheds for new Army Supply Depot for Quartermaster's Department, U. S. A. Rankin, Kellogg & Crane are Archs., 1012 Walnut St., Philadelphia, Pa.

MOSQUITO BARS.—New York, N. Y.—Bids are asked by Col. Wm. S. Patten, Depot Q. M., New York, until 1 p. m., Aug. 10, for furnishing and delivering at either the New York or Philadelphia depot of the Quartermaster's Department, U. S. A., 20,000 mosquito bars, single, and 3,500 mosquito bars, double, subject to increase in quantities of from 20 per cent. to 50 per cent. if desired by this department.

BLOCK SIGNALS.—New York, N. Y.—Bids were received as follows by the Department of Bridges on July 30 for the construction of block signals for the elevated railway tracks of the Williamsburg (new East River) Bridge over the East River, between the Boroughs of Manhattan and Brooklyn: Gore Engineering & Contracting Co., 206 Broadway, $24,-993; Charles Meads & Co., 299 Broadway, $46,000; McHarg-Bart & Co., 299 Broadway, $39,133; North Eastern Construction Co., 225 Fifth Ave., $34,680. J. W. Stevenson is Comr. The above bids have been rejected. New bids are asked until Aug. 11.

BROKEN TRAP STONE AND SCREENINGS.—New York, N. Y.—Bids were received on Aug. 4 by Louis F. Haffen, Pres. Boro. of the Bronx, for furnishing and delivering broken trap rock stone and screenings (22,-000 cu. yds. 1¼-in. trap rock stone and 8,000 cu. yds. ½-in. trap rock screenings), (a) per cu. yd.; (b) total: Manhattan Trap Rock Co., 114 Liberty St., (a) $1.93, (b) $57,900; Rockland Lake Trap Rock Co., 299 Broadway, (a) $1.98, (b) $59,400; Clinton Point Trap Rock Co., 170 Broadway, (a) $2.15, (b) $64,500.

MARSH IMPROVEMENT. — Leamington, Ont.—Bids were received by Alex. Baird, C. E., Leamington, July 28 for improvement of the marsh drainage system on Pelee Island. The work comprises principally dredge work, with team work, rock blasting, supplying and placing in new pumps of 40,000 gallons capacity per minute, new steam boiler, repairing present pumping plants, building concrete pump pit, spill-way, bridges, etc. Contract was awarded to GILMORE BROS., Toledo Ohio, for dredge work, rock blasting and bridges; to PARK BROS., Chatham, Ont., contract for pumps, boilers, concrete work. Estimated cost, $42,000.

FENCES.—New York, N. Y.—Bids were received as follows by the Department of Parks on July 30, for furnishing all the labor and materials for completely constructing and erecting boundary and partition fences for the elephant house yards in the New York Zoological Park in Bronx Park, City of New York: F. T. Nesbit & Co., 116 Nassau St., $17,482; McHarg, Bart & Co., 299 Broadway, $13,700; Gore Engineering & Contracting Co., 206 Broadway, $24,393; Page Woven Wire Fence Co., 1235 Broadway, $21,-879; New Jersey Foundry & Machinery Co., 9 Murray St., $17,229; J. W. Fisk Iron Works, 56 Park Pl., $17,777.

STEEL PIPE LINE.—Valley Stream, N. Y.—Bids were received as follows by John H. O'Brien, Comr. Water Supply, Gas and Electricity, on July 29, for the furnishing, delivering and laying a 72-in. steel pipe line and appurtenances from Valley Stream, L. I., to Amityville, L. I.: Stewart-Kerbaugh-Shanley Co., 527 Fifth Ave., $2,180,530; John H. Holmes, 87 Nassau St., $2,016,132; John J. Hart & Co., Westchester and Pugsley Aves., $2,192,339; Ryan-Parker Const. Co., 13 Park Row, $1,928,182; Cooper-Evans Co., 220 Broadway, $1,875,302; Henry B. Reed, $2,-344,205; T. A. Gillespie Co., 90 West St., on 7/16-in. pipe, $1,945,390, on ⅝-in. pipe, $2,099,865.

*QUAY WALL, PIER, ETC.—Key West, Fla.—Bids were received as follows on Aug. 1 by Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing a steel and concrete quay wall and pier on timber piles, and a steel and concrete coal shed at the naval station, Key West, Fla.: Penn Bridge Co., 312 Bond Bldg., Washington, D. C., (item 1) $253,439; (2) $99,000; (4) $7,276. W. W. Lindsay & Co., 902 Harrison Bldg., Philadelphia, Pa., (item 1) $284,-900; (2) $103,000; ((3) $110,000; (4) $17,000. Grant Wilkins, 23¼ Whitehall St., Atlanta, Ga., (1) $270,600; (2) $100,070; (3) $109,900. Conveying Machinery Co., 120 Liberty St., New York, (1) $490,788-. (2) $47,200. The Snare & Triest Co., 143 Liberty St., New York. (1) $262,000; (2) $80,000; (3) $35,000; (4) $2,600.

CANAL.—Stockton, Cal.—Bids were received as follows on July 8 by Lieut.-Col. John Biddle, Corps Engrs., U. S. A., San Francisco, for constructing a diverting canal north and east of Stockton: (a) construction of Calaveras Section, (b) Canal Section, on one side of canal, (c) Canal Section, two-thirds on one side of canal: F. S. Boggs, (c) $154,230; American Dredging Co., (a) $105,567; Flynn & Treacy, (b) $213,311, (c) $179,947; Chadwick & Sykes, (c) $212,139; Ed. Malley, (a) $90,045, (b) $198,222, (c) $160,687; Lewis Moreing, (a) $84,478, (b) $214,264, (c) $172,559; San Francisco Bridge Co., (a) $78,373, (b) $152,801, (c) $150,716; Mahoney Bros., (b) $183,006, (c) $176,753; California Reclamation Co., (a) $72,520; Standard American Dredging Co., (b) $141,-223; (c) $128,712; J. C. Franks, (a) $96,936, (c) $166,198. Itemized bids will be given next week under Contract Prices.

RETAINING WALL, ETC.—Philadelphia, Pa.—Bids were received as follows on Aug. 1, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing a continuation of the retaining wall and a pier in the reserve basin, navy yard, Philadelphia: Lawler Bros. Construction Co., 13 Park Row, New York, (Item 1) $53,777; (2) $43,777. American Paving & Construction Co., 211 South Ninth St., Philadelphia, Pa., (Item 1) $59,000; (2) $43,700; (3) $8,000; (4) $55,000; (5) $14. McGaw & Gray, 710 Pennsylvania Bldg., Philadelphia, (Item 1) $74,-200; (2) $52,100; (3) $9,000; (4) $68,100; (5) $50. William Krug Construction Co., 9 German American Bldg., Philadelphia, (Item 1) $54,637; (2) $44,236; (3) $4,957; (4) $49,680; (5) $15. Phoenix Construction Co., 41 Park Row, New York, (Item 1) $863,941; (2) $49,-543; (3) $6,157; (4) $57,874; (5) $13; (6) $48,048; $46,000; $44,486; $42,576. Blackstaff Engineering Co., 1332 Walnut St., Philadelphia, (Item 1) $71,000; (2) $54,000; (3) $6,500; (4) $65,000; (5) $20. Edward F. Fonder, 1116 Land Title Bldg., Philadelphia, (Item 1) $74,039; (2) $53,577; (3) $7,458; (4) $66,581; (5) $19.

*DREDGING.—Newport, R. I.—Bids were received as follows on July 22 by Maj. Harry Taylor, Corps Engrs., U. S. A., Newport, for dredging and removing rock from the Pawtucket River, R. I. (A) dredging, per cu. yd.; (B) rock removal per cu. yd.: Coastwise Dredging Co., Norfolk, Va., (A) $16.9 cts.; (B) $8.25. P. Sanford Ross, Inc., Jersey City, N. J., (A) 24.5 cts.; (B) $8.40. R. G. Packard Co., New York, (B) $7.70. The International Contracting Co., New York, (A) 20 cts.; Degnon Contracting Co., New York, (A) 17 2/3 cts.; (B) $8.50. John J. Fitzpatrick, Plattsburg, N. Y., (B) $6.60. W. H. Beard Dredging Co., New York, (A) 22 4 cts. J. S. Packard, Providence, R. I., (A) 14 6/7 cts. Maritime Dredging Co., New York, (A) 34 cts.; (B) $18. Roy H. Beattie, Fall River, Mass., (B) $7.20. Johnston & Virden, Lewes, Del., (A) 26.5 cts.; (B) $6.92

*INLAND WATERWAY.—Wilmington, N. C.—Bids were received as follows on July 27 by Capt. Earl I. Brown, Corps of Engrs., U. S. A., Wilmington, for constructing an inland waterway from Pamlico Sound to Beaufort Inlet, S. C.—(A) Division A (1,800,-000 cu. yds.); (B) Division B (1,800,000 cu. yds.); (C) both divisions (3,600,000 cu. yds.): P. Sanford Ross, Inc., Jersey City, N. J., (A) $244,800; Maryland Dredging & Contracting Co., Baltimore, Md., (C) $387,000; Atlantic Dredging Co., Philadelphia, Pa., (A) $243,000, (B) $378,000; Coastwise Dredging Co., Norfolk, Va., (B) $357,750; Sanford & Brooks Co., Baltimore, Md., (A) $324,000, (B) $414,000; John Anderson, Gulfport, Miss., (C) $423,000; Roderick G. Ross, Jacksonville, Fla., (A) $178,200; Atlantic, Gulf & Pacific Co., New York, N. Y., (A) $171,000; North American Dredging Co., New York, N. Y., (A) $193,500, (B) $260,440, (C) $422,640.

*DREDGING.—Detroit, Mich.—Bids were received as follows by Lt.-Col. C. McD. Townsend, Corps Engrs., U. S. A., on July 21 for dredging Hay Lake and Neebish Channels, St. Marys River, Mich.: (A) Section 3, Item Q—Little Mud Lake, 295,000 cu. yds. full rate; 197,000 cu. yds. half rate, price per cu. yd. (B) Section 4, Item R—Sailors' Encampment, 60,700 cu. yds. full rate; 43,000 cu. yds. half rate, price per cu. yd.: The Lake Erie Dredging Co., Buffalo, N. Y., (A) 24.5 cts. Standard Contracting Co., Cleveland, Ohio, (A) 29 cts.; (B) $2.95. Great Lakes Dredge & Dock Co., Chicago, Ill., (A) 33.9 cts.; (B) $3.19. Duluth Marine Contracting Co., Duluth, Minn., (A) 24.5 cts. Samuel O. Dixon, Milwaukee, Wis., (A) 34.8 cts. Zenith Dredging Co., Duluth, Minn., (A) 35.5 cts. Greiling Bros., Green Bay, Wis., (A) 43 cts. Hickler Bros., Sault Ste Marie, Mich., (B) $3.39. T. L. Durocher, John P. Conrick and Joseph Ganley, Sault Ste Marie, Mich., (B) $3.47. Edward Bros., Sault Ste Marie, Mich., (A) 46 cts.; (B) $4.

CLEANING AND PAINTING STEEL.—New York, N. Y.—Bids were received as follows on Aug. 4 by John Cloughen, Acting-Pres. Boro. Manhattan, for cleaning and painting complete, all the iron and steel work of (a) the Riverside Drive viaduct, Boro. of Manhattan, together with all work incidental thereto. Engineer's estimate of amount of work to be done: 7,000 tons of iron and steel. Also, at the same time, for cleaning and painting, complete, all the iron and steel work of (b) the 155th St. viaduct, Boro. of Manhattan, including tin roofs of all stairways, together with all work incidental thereto. Engineer's estimate, 3,800 tons of iron and steel: Edward Thierault, 898 Quincy St., Brooklyn, (a) $14,800, (b) $10,969; N. B. Smythe, 1123 Broadway, (a) $16,941, (b) $14,849; H. A. Jackson, 228 West 23d St., (a) $12,777, (b) $9,773; William Flannagan, 835 Atlantic Ave., Brooklyn, (a) $14,961, (b) $15,300; James H. Ferguson, (a) $14,145, (b), $9,745; James K. Murray, 169 Lorimer St., Brooklyn, (b) $18,-000; Bassilarious Contracting Co., 154 Nassau St., (b) $17,000.

TORPEDO BOAT SLIPS.—Charleston, S. C.—Bids were received as follows July 25 at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for construction of wooden piers for torpedo boats, Charleston, S. C., Navy Yard: (a) one 30-ft. pier and a number of 10-ft. piers; (b) one 30-ft. pier, three 10-ft. piers and a number of 5-ft.: (c) same as (a) of different grade of pine; (d) same as (b) of different grade of pine; (e) on bidders' specifications. Penn Bridge Co., Bond Bldg., Washington, (a) one 30-ft.; six 10-ft., $48,000; (b) three 5-ft., $48,000. William Miller, 19 Milk St., Boston, (a) five 10-ft., $47,500; (b) two 5-ft. $46,700; (c) $45,890; (d) $45,500; (e) $47,600. Andrew Miller, 3122 Foster St., Baltimore, (a) five 10-ft., $45,460; (b) three-ft., $48,000; (c) $45,460; (d) $48,000. Simons-Mayrant Co., Charleston, S. C., (a) five 10-ft., $44,298; (b) three 5-ft., $46,599; (c) $43,118; (d) $45,-745; (e) $47,039, $47,821. Phoenix Construction Co., 41 Park Row, New York, (a) five 10-ft., $47,670; (b) two 5-ft., $46,838; (c) $45,913; (d) $45,244. Gadsden Contracting Co., Savannah, Ga., (a) six 10-ft., $47,900; (b) three 5-ft., $45,200; (c) $45,990; (d) $47,150. Grant Wilkins, 23¼ Whitehall St., Atlanta, Ga., (a) five 10-ft., $47,500; (b) two 5-ft., $46,600. Contract has been awarded to the PENN BRIDGE CO.

COAL-HANDLING PLANT.—New York, N. Y.—Bids were received as follows by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., on Aug. 1 for a coal-handling plant for the power-house, navy yard, New York: Guarantee Construction Co., 140 Cedar St., New York (Item 1), $36,340; (2) $29,-350; (3) $2,625 and $2,325. Charles O. Lenz, 66 Broadway, New York (Item 4), $47,753; (5) $42,953; (8) $47,753 and $49,553. C. O. Bartlett & Snow Co., 1040 French St., Cleveland, Ohio (Item 1), $21,354; (2) $20,521; (3) $1,600. Belmont Iron Works, 22d and Washington Aves., Philadelphia (Item 1), $26,480 and $24,130. Bergen Point Iron Works, 149 Broadway, New York (Item 1), $27,237 and $31,876; (2) $22,497; (3) $2,596, $2,986 and $2,206; (9) $1,477. Link-Belt Co., Nicetown, Philadelphia (Item 1), $35,520; (2) $31,345; (3) $4,160 and $4,150; (4) $35,666; (5) $31,491; (8) $2,035, $2,108 and $5,300. Dobbie Foundry & Machine Co., 82 Warren St., New York (Item 1), $30,210; (2) $29,719; (3) $1,508; (8) $30,661 plus $1,061, $31,411 plus $1,100 and $30,836 plus $1,136. Darley Engineering Co., 80 Broadway, New York (Item 8), $7,417. Wm. J. Haskins, 96 Liberty St., New York (Item 1), $27,644; (3) $3,060. G. & W. Mfg. Co., 26 Cortlandt St., New York (Item 1), $31,913; (2) $31,000; (3) $1,200. Conveying Machinery Co., 120 Liberty St., New York (Item 1), $41,689; (2) $39,464; (3) $35,292; (4) $42,646; (5) $42,012; (8) $38,412. Conveying Machinery Co. (Item 1), $39,176; (2) $38,007; (3) $34,784. Conveying Machinery Co. (Item 4), $44,388; (5) $43,812; (8) $44,388. Conveying Machinery Co. (Item 4), $45,112; (5) $44,913; (8) $45,102.

BARGE CANAL.—Albany, N. Y.—The Canal Board at its last meeting approved the plans and specifications, submitted by Frederick Skene, State Engr. and Surveyor, for five additional contracts for Barge Canal construction work, as follows:

Contract No. 13: which is for furnishing and erecting in place five steel highway bridge superstructures, being three on the site of Contract No. 12, and two on the site of Contract No. 18.

Contract No. 61: for the improvement of the present Erie Canal from the west end of Contract No. 60 to the west line of Monroe County; length 7.39 miles. The work includes the widening and deepening of the present canal, protecting its sides; constructing new culverts; waste weirs and highway bridges.

Contract No. 66: for the improvement of the present Erie Canal from the west end of Contract No. 64 to about 600 feet east of the Lockport locks. Length, 6.35 miles. The work in this contract also includes the widening and deeping of the canal and the construction of various culverts and highway bridges.

Contract No. 55: for constructing a reservoir dam on the Mohawk River; relocating a portion of the Black River Canal; building four locks and performing other work pertaining to the contract. Area of reservoir inside clearing line about five square miles.

Contract No. 20 is for dredging a channel in the Mohawk River from Rexford Flats to Little Falls, a distance of about 53 miles. This contract already has been advertised, but no bids were received for the work. The plans and specifications have recently been revised. It is expected bids will be asked for these contracts by F. C. Stevens, Supt. of Public Works, within two or three weeks.

U. S. POSSESSIONS AND CUBA.

(denotes that this work is advertised in Engineering News.)*

BOX-CARS. — Panama. — Recommendation has been made by Col. Geo. W. Goethals, Chairman Isthmian Canal Commission to award contract for furnishing 300 box-cars to the AMERICAN CAR & FOUNDRY CO., Wilmington, Del., at $1,001 each. These cars are for use on the Panama Railroad. Award will be made in a few days.

*CABLE RAILWAYS.—Panama.—Bids are asked by Capt. F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer, Isthmian Canal Comn., Washington, D. C., until 10.30 a. m., Aug. 31, for furnishing cable railways with grip cars, electric railways with motor cars, traveling cranes, and stone, sand and cement valves. Circular No. 460.

CARS, GAGES, CROSS-TIES, ETC.—Panama.—Bids will be received until Aug. 24 by Capt. F. C. Boggs, Corps Engrs., U. S. A., Gen. Purchasing Officer of the Isthmian Canal Comn., Washington, D. C., for furnishing cross-ties, lumber, steel, flat cars, push and hand cars, track gages and levels, jacks, repair parts for dump cars and dredges, bolts, breast drills, rock drills, etc.

LOCOMOTIVES, DUMP CARS.—Panama.—Bids will be received until Aug. 13 by Capt. F. C. Boggs, Corps Engrs., U. S. A., Gen. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for furnishing locomotives and dump cars. Circular No. 458. Bids are asked until Aug. 17 for furnishing shop machines, pumps, jacks, twist drills, milling cutters, carborundum wheels, etc. Circular No. 457.

ELECTRICAL SUPPLIES, ETC.—Panama.—Bids will be received at the office of the General Purchasing Officer of the Isthmian Canal Commission, Washington, D. C., until Aug. 10 for furnishing the following supplies: Turbo-generator, switchboard, locomotive crane, derricks, launch, electrical supplies, copper gaskets, etc. Circular No. 456. Capt. F. C. Boggs, Corps Engrs., U. S. A., is Gen. Purchasing Officer.

LUMBER.—Panama.—Bids were received as follows July 29 at the Isthmian Canal Commission, Washington, D. C., for furnishing (a) 287,000 ft. B. M. creosoted lumber, and (b) 61,000 lin. ft. creosoted piling: Atlantic Creosoting & Wood Preserving Works, Norfolk, Va. (a) $13,237, 140 days; (b) $21,-933, Va. or N. C. yellow pine, no time stated. Arthur Gamwell, Seattle, Wash., $12,202, fir; (b) $29,200, fir, 120 days. Gulfport Creosoting Co., Gulfport, Miss. (a) $12,069, pine, 90 days; (b) $24,127, pine, 90 days. Southern Creosoting Co., Slidell, La., (a) $13,298, pine, 90 days; (b) $23,086, 90 days; inspection at plant. Southern Sawmill Co., New Orleans, (a) $11,887, 100 days. Wyckoff Pipe & Creosoting Co., Inc., 50 Church St., New York, (a) $14,080, 110 days. W. R. Grace & Co., 1 Hanover Sq., New York, (a) $11,350, fir; (b) $24,614, fir, both 100 days. Norfolk Creosoting Co., Norfolk, Va., (a) $13,873, long leaf yellow pine, 115 days; $13,391, short leaf, 90 days; (b) $32,531, long leaf, 120 days; $28,206.94, short leaf, 100 days.

Contracts have been awarded as follows: W. R. GRACE & CO., creosoted piling, La Boca delivery, $22,493; 250,000 ft. B. M., creosoted lumber, $9,886; 85,000 ft. B. M., untreated lumber, $1,947; 287,000 ft. B. M., creosoted lumber, $11,350; all Douglas fir, delivery 90 and 100 days. GULFPORT CREOSOTING CO., 61,000 lin. ft. creosoted piling, yellow pine, $24,127; 90 days.

CONTRACT PRICES.

[Where * precedes items under Contract Prices the work was advertised in Engineering News.]

*AQUEDUCT.—New York, N. Y.—Bids in detail were received as follows by the Board of Water Supply on July 23 for the construction of a portion of the Catskill aqueduct, consisting of about 6½ miles of plain concrete conduit, known as cut-and-cover aqueduct, west of the Hudson River, on the south side of Esopus Creek Valley, in the towns of Olive and Marbletown, Ulster County, New York: (A) STEWART-KERBAUGH-SHANLEY CO., 527 Fifth Ave., New York (awarded contract); (B) Elmore & Hamilton Contracting Co., 56 Tweddle Bldg., Albany; (C) Rinehart & Dennis Co., Washington, D. C.; (D) Gore Engineering & Contracting Co., 206 Broadway, New York; (E) John J. Hart Co., 26 Beaver St., New York; (F) Millard Construction Co., 704-709 Pennsylvania Bldg., Philadelphia, Pa.; (G) Cranford Co., 190 Montague St., Brooklyn; (H) David Peoples, 271 Broadway, New York; (I) Bradley Contracting Co., 329 West 68th St., New York:

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
65,000 cu. yds. removal of topsoil	$0.57	$0.32	$0.60	$0.60	$0.30	$1.30	$1.00	$0.60	$1.00
Open cut excavation—									
20,000 cu. yds., Sta's 95 to 110, type B	.48	.40	.60	.65	1.25	1.27	.93	.70	1.50
32,000 cu. yds., Sta's 110 to 122+25, type A	.44	.40	.60	.65	.92	1.27	.93	.70	1.50
61,000 cu. yds., Sta's 130 to 160, type A	.48	.50	.60	.65	.99	1.27	.97	.70	1.50
80,000 cu. yds., Sta's 160 to 210, type A	.55	.65	.65	.90	1.14	1.27	1.41	.92	1.50
27,000 cu. yds., Sta's 210 to 237, type B	.74	.60	.70	1.20	1.14	1.27	1.21	1.26	1.50
35,000 cu. yds., Sta's 237 to 256, type B	.93	.65	.75	1.40	1.29	1.27	1.59	1.64	1.50
30,000 cu. yds., Sta's 256 to 273, type B	.48	.42	.60	.75	.99	1.27	.93	.70	1.50
41,000 cu. yds., Sta's 273 to 314, type B	1.60	.65	.80	1.40	1.27	1.27	1.37	1.65	1.50
38,000 cu. yds., Sta's 314 to 325+50, type B	1.50	.70	.90	1.80	1.37	1.27	1.53	2.03	1.50
31,000 cu. yds., Sta's 325+50 to 346, type B	.48	.40	.60	1.00	.99	1.27	.93	.70	1.50
38,000 cu. yds., Sta's 346 to 368, type B	.80	.65	.80	1.20	1.32	1.27	1.25	1.39	1.50
15,000 cu. yds., Sta's 402+70 to 407, type A	.93	.60	.90	1.60	1.32	1.27	1.57	2.00	1.50
15,000 cu. yds., Sta's 407 to 420, type A	.51	.50	.60	.75	.99	1.27	.98	.80	1.50
75,000 cu. yds., Sta's 420 to 478+50, type B	.52	.45	.60	.65	.99	1.27	.93	.70	1.50
Refilling and embanking—									
21,000 cu. yds., Sta's 95 to 110	.37	.30	.40	.35	.53	.30	.32	.25	.75
22,000 cu. yds., Sta's 110 to 122+25	.37	.30	.40	.35	.53	.30	.32	.25	.75
45,000 cu. yds., Sta's 130 to 160	.37	.30	.40	.35	.53	.30	.32	.25	.75
76,000 cu. yds., Sta's 160 to 210	.37	.30	.40	.35	.53	.30	.32	.30	.75
55,000 cu. yds., Sta's 210 to 237	.53	.35	.40	.40	.53	.30	.71	.25	.75
19,000 cu. yds., Sta's 237 to 256	.37	.30	.40	.35	.53	.30	.32	.25	.75
21,000 cu. yds., Sta's 256 to 273	.37	.30	.40	.35	.53	.30	.32	.25	.75
75,000 cu. yds., Sta's 273 to 314	.42	.35	.40	.35	.53	.30	.71	.45	.75
8,000 cu. yds., Sta's 314 to 325+50	.42	.30	.40	.40	.53	.30	.32	.20	.75
32,000 cu. yds., Sta's 325+50 to 346	.37	.30	.40	.35	.53	.30	.32	.25	.75
33,000 cu. yds., Sta's 346 to 368	.37	.30	.40	.35	.53	.30	.50	.25	.75
3,000 cu. yds., Sta's 402+70 to 407	.42	.30	.40	.40	.53	.30	.32	.50	.75
24,000 cu. yds., Sta's 407 to 420	.42	.35	.40	.40	.53	.30	.55	.25	.75
77,000 cu. yds., Sta's 420 to 478+50	.37	.30	.40	.35	.53	.30	.32	.35	.75
42,000 cu. yds. surface dressing and grassing	.45	.40	.60	.50	.45	.50	.50	.50	1.00
165,000 cu. yds. concrete masonry for aqueduct in open cut and embankment	5.42	6.25	6.00	5.00	4.64	5.80	7.39	4.90	9.00
10,000 cu. yds. concrete masonry for culverts, retaining walls, etc.	5.42	6.25	6.00	5.00	7.50	10.00	7.50	8.00	9.00
5,000 cu. yds. dry rubble masonry and paving	3.00	3.25	4.00	3.00	2.50	3.00	3.00	3.00	4.00
1,000 cu. yds. crushed stone and gravel	2.00	1.60	2.00	2.00	2.25	2.50	2.00	2.50	3.00
4 sluice gates	75.00	80.00	200.00	150.00	120.00	300.00	500.00	125.00	500.00
8 tons c.-i. pipes and special castings	100.00	80.00	100.00	80.00	120.00	100.00	100.00	100.00	100.00
1,000 lin. ft. vitrified pipe	1.50	.40	2.00	2.00	1.50	1.50	1.50	1.00	1.00
250 M. ft. timber and lumber	40.00	55.00	60.00	60.00	60.00	50.00	70.00	60.00	75.00
12 testing portions of aqueduct, per por.	1,000.00	400.00	1,000.00	1,200.00	500.00	1,000.00	3,000.00	1,500.00	1,000.00
2,000 lin. ft. excess testing portions of aqueduct exceeding 200' in length	5.00	1.50	2.00	2.00	5.00	8.00	5.00	2.00	5.00
40,000 cu. yds. excavation in tunnel	4.10	3.75	4.75	5.60	4.97	6.20	7.50	7.00	7.00
400 sq. yds. additional trimming in tunnel	5.00	2.00	5.00	5.00	2.88	6.00	5.00	6.00	10.00
100 M. ft B. M. permanent timbering in tunnel	50.00	60.00	60.00	75.00	60.00	60.00	80.00	60.00	100.00
50 M. ft. B. M. temporary timbering in tunnel	50.00	55.00	100.00	85.00	67.50	50.00	80.00	60.00	75.00
3,470 lin. ft. tunnel drainage	1.50	1.00	2.00	2.00	1.50	1.50	2.00	1.00	4.00
3,470 lin. ft. forms for masonry lining in tunnel	4.00	2.00	3.00	4.00	4.50	4.50	10.00	4.00	5.00
11,000 cu. yds. concrete masonry in tunnel	4.92	6.50	7.00	6.50	8.00	6.00	6.50	9.00	10.00
700 cu. yds. excess concrete masonry in tunnel	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
200 cu. yds. brick masonry in tunnel	15.00	14.00	20.00	20.00	25.00	15.00	15.00	20.00	20.00
2,000 cu. yds. dry packing	2.50	2.00	3.00	2.50	2.35	3.00	3.00	1.50	3.00
200 lin. ft. drilling holes in rock or masnry	1.00	.40	1.00	1.00	1.05	.50	1.00	.50	1.00
1,000 lin. ft. steel pipes for grouting	.50	.20	.20	.50	.55	.50	1.00	.25	.50
250,000 bbls. Portland cement	1.50	1.80	1.85	2.00	1.80	1.95	1.65	2.00	2.00
750 cu. yds. grout of Portland cement	8.10	6.00	6.00	8.00	18.00	8.00	5.00	5.00	6.00
63,000 lin. ft. stone boundary walls	1.00	1.50	1.20	1.00	.90	.90	.90	1.30	2.00
17,000 lin. ft. fences and guard rails	.25	.50	.35	.30	.45	.40	.30	.40	.50
100,000 lbs. steel for reinforcing concrete	.05	.05	.08	.05	.06	.06	.04	.05	.05
6,000 lbs. wrought iron, cast iron and steel	.06	.06	.08	.08	.13	.10	.05	100.00	.06
2,500 lbs. bronze	.50	.60	.80	.50	.50	.50	.75	.75	.80
Cleaning up (lump sum)	18,000.00	7,000.00	10,000.00	25,000.00	5,320.00	10,000.00	35,000.00	15,000.00	10,000.00
Totals	$2,368,920	$2,456,960	$2,627,230	$2,964,640	$2,688,877	$3,008,710	$3,293,025	$3,379,485	$4,064,090

Engineer's estimate, $3,137,665.

STORM SEWERS, PAVEMENT.—Mobile, Ala.—Bids were received on July 13 by the Board of Public Works for the construction of storm sewers, pavements, etc. Wright Smith is Ch. Engr. The bids in detail are here given: (A) JETT BROS., Mobile (awarded all contracts); (B) C. M. Burkhalter, Birmingham, Ala.; (C) Bosler & Flynn, Chattanooga, Tenn.; (D) Irwin Bros., New Orleans, La.; (E) Lee & Everroad, Columbus, Ind.; (F) Russell & Jennison, Toledo, Ohio; (G) John B. Turner, St. Louis, Mo.; (H) Sullivan & Long, Bessemer, Ala.; (I) Venable & McCandless, Atlanta, Ga.; (J) Chickamauga Quarry & Construction Co., Chattanooga; (K) Bryan & Sonders, Atlanta; (L) Bigler Bros., Bessemer, Ala.:

Storm sewers—	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
1,000 lin. ft. 36" vitrified pipe	$6.20	$9.00	$7.69	$7.10	$7.00	$6.54	$5.19	$6.70
1,920 " " 24" vitrified pipe	2.29	3.00	4.33	3.40	2.50	2.50	2.30	2.95
760 " " 20" vitrified pipe	1.77	2.60	2.36	1.70	1.50	1.85	1.70	1.85
1,040 " " 18" vitrified pipe	1.52	1.75	2.32	1.45	1.25	1.70	1.45	1.75
2,090 " " 15" vitrified pipe	1.25	1.25	1.59	.98	1.05	1.45	1.00	1.40
480 " " 12" vitrified pipe	.78	1.00	.64	.63	.80	1.20	.64	.95
3,220 " " 10" vitrified pipe	.62	.60	.38	.45	.65	.85	.45	.75
15,350 " " 6" vitrified pipe	.32	.50	.37	.25	.55	.38	.31	.29
24 standard manholes	32.76	45.00	45.00	39.00	30.00	45.00	50.00	33.00
54 standard inlets	26.40	25.00	30.00	31.00	25.00	20.00	20.00	25.00
26 special catch basins	21.84	25.00	55.0	24.00	25.00	14.00	15.00	20.00
100 cu. yds. extra concrete	6.50	8.00	10.00	7.00	5.50	5.60	8.00	10.00
10,000 ft. B. M. extra lumber	25.00	15.00	30.00	30.00	20.00	34.00	12.00	20.00
120 lin. ft. 3 × 2.5 concrete culvert	2.65	5.00	3.30	3.50	4.50	3.80	1.10	8.00
256 " " 3 × 2 concrete culvert	2.60	5.00	3.25	3.30	4.50	3.40	1.30	7.00
Total	$28,639	$34,449	$38,003	$30,203	$33,146	$32,029	$25,533	$33,055

Wood block pavement	(A)	(I)	(J)	(K)	(F)	(G)
34,712 sq. yds. 4" concrete foundation	$0.65	$0.80	$0.68	$0.81	$0.70	$1.21
34,712 sq. yds. wood block surface	1.63¾	1.74	1.87	1.67	1.80	1.00
2,906 lin. ft. granite curbing	.46	.44	.60	.58	.50	.55
Total	$80,681	$89,474	$90,295	$87,806	$88,203	$78,345

Cement curbing—11,744 lin. ft.—Bids as follows: (A) 35 cts. a lin. ft.; (L) 34½ cts.; (E) 41 cts.; (F) 45 cts.; (G) 29 cts. Total bids. (A) $4,110.40; (L) $4,051.68; (E) $4,815.04; (F) $5,284.80; (G) $3,405.76.

Vitrified brick pavement—	(A)	(F)	(G)
2,902 sq. yds. 4" concrete foundation	$0.65	$0.70	$1.15
2,902 sq. yds. vitrified brick surface	1.60	2.10	1.00
2,582 lin. ft. granite curbing	.46	.50	.55
Total	$7,717	$9,417	$7,659

Contract Prices continued on next page.

FOREIGN CONTRACTS.

(To insure prompt attention, letters upon consular business should be addressed to the American Consul at ———, ——— Such letters are opened and attended to by the person that may be in charge of the office. If addressed to the consul, personally, letters are forwarded to him, unopened, should he be absent, and a delay thus intervenes. If, in the meantime, he should have gone out of office the matter may wholly escape attention.)

RAILWAY.—Belgium.—Bids are asked at the office of the Societe Nationale des Chemins de Fer Vicinaux, Rue de la Science 14, Brussels, at 11 a. m., Aug. 19, for the construction of portions of the local railway between Mons and Quevy. Estimated cost, 119,100 fr. (about $23,820). Deposit, 12,000 fr. (about $2,400).

*SEWERS AND PAVING.—Ecuador.—Bids are asked until Dec. 1, by the Sewerage and Water Supply Board of the city of Guayaquil, Ecuador, for sewer and paving work in Guayaquil. Plans, specifications, etc., may be obtained at the International Bureau of the American Republics, 2 Jackson Pl., Washington, D. C. Felicisimo Lopez is Consul General, 11 Broadway, New York.

WATER-WORKS.—Egypt.—Bids are asked until noon, Aug. 27, for the construction of water supply works in the town of Benha. The works required include a pumping station, with tower and reservoir, the construction of wells, installation of apparatus and machinery, laying of conduits, etc. Bids should be addressed to H. E. the Under Secretary of State, Ministry of the Interior, Cairo.

RESERVOIR PIPE, ETC.—India.—Bids are asked by the Commissioners of the Corporation of Calcutta from responsible firms for the construction and erection at Calcutta of a raised steel tank or reservoir to hold 9,000,000 gallons of water. Bids will be opened at 3 p. m., Nov. 4.

Bids are asked until 3 p. m., Oct. 29, by the Commissioners of the Corporation of Calcutta for the supply and laying complete of a system of 6-ft. and 5-ft. steel mains, together with branches, sluice valves, washouts, etc.

ENGINEERING MATERIAL PRICES.

TRACK FASTENINGS—

Pittsburg, f. o. b. cars—Angle bars, 1.45 to 1.65 cts.; spikes, standard sizes, [illegible] 9-16-in., at $1.70, and the smaller sizes at $1.80 per 100 lbs. in carload and larger lots, with an advance of 5 cts. per 100 lbs. for less than carload; f. o. b. Pittsburg; square nuts, 2.55 to 2.65 cts.; bolts, hexagonal nuts, 2.70 to 2.80 cts.

RAILS, STEEL—

New York—at mill—New standard sections, $28; standard, second quality, $27 to $28; light sections, 12 to 14 lbs., $34 to $36. Per gross ton—Heavy melting steel scrap, $11 to $11.50; old steel rails, rerolling lengths, $12.50 to $13.50; relaying rails, $21 to $22; old iron rails, $15 to $16.50.

Pittsburg—Standard sections, at mill, $28; standard, second quality, $27 to $28; light rails, 25 to 45-lb. sections, $29; 20-lb., $29; 16-lb., $38; 12-lb., $37; 10-lb., $34, and 8-lb., $38.

STRUCTURAL MATERIALS—

Pittsburg, f. o. b. mill—Beams and channels, 3 to 15-in., inclusive, 1.60 cts. net; beams over 15-in., 1.70 cts., net; angles, 3 to 6-in., inclusive, ¼-in. and up, 1.60 cts., net; angles, over 6 ins., 1.70 cts., net; angles, 3 × 3 ins. and up, less than ¼-in., 1.50 cts., base, half extras, steel bar card; tees, 3-in. and up, 1.65 cts., net; zees, 3-in. and up, 1.60 cts, net; angles, channels and tees under 3-in., 1.50 cts., base, half extras, steel bar card; deck beams and bulb angles, 1.90 cts., net; hand rail tees and Z-19, 3 cts., net; checkered and corrugated plates, 3 cts., net.

Chicago—at mill—Beams and channels, 3 to 15-in., inclusive, 1.78 cts.; angles, 3 to 6-in., ¼-in. and heavier, 1.78 cts.; larger than 6-in. on one or both legs, 1.88 cts.; beams, larger than 6-in. on one or both legs, 1.88 cts.; beams, larger than 15-in., 1.88 cts.; zees, 3-in. and over, 1.78 cts.; tees, 3-in. and over, 1.83 cts.

New York—at tidewater—Beams, channels, angles and zees, 1.76 cts.; tees, 1.81 cts.; on beams, 18 to 24-in., and angles over 6-in., the extra is 0.10 cts.

PLATES AND SHEETS—

New York—at tidewater—Standard-sized plates—Sheared plates, 1.76 cts. to 1.86 cts.; flange plates, 1.86 cts. to 1.96 cts.; marine plates, 2.16 cts. to 2.26 cts.; firebox plates, 2.65 cts. to 3.50 cts., according to specifications.

Pittsburg—mill shipment—Blue annealed sheets, No. 10 and heavier, 1.80 cts.; Nos. 11 and 12, 1.85 cts.; Nos. 13 and 14, 1.90 cts.; Nos. 15 and 16, 2 cts.; box annealed, Nos 17 to 21, 2.25 cts.; Nos. 22 to 24, 2.30 cts.; Nos. 25 and 26, 2.35 cts.; No. 27, 2.40 cts.; No. 28, 2.50 cts.; No. 29, 2.60 cts.; No. 30, 2.70 cts.; galvanized sheets, Nos. 10 and 11, 2.45 cts.; Nos. 12 and 14, 2.55 cts.; Nos. 15 and 16, 2.65 cts.; Nos. 17 to 21, 2.80 cts.; Nos. 22 and 24, 2.95 cts.; Nos. 25 and 26, 3.15 cts.; No. 27, 3.35 cts.; No. 28, 3.55 cts.; No. 29, 3.70 cts.; No. 30, 3.95 cts.

IRON—

Pig Iron:

At New York—tidewater—

Northern—	
No. 1. foundry	$16.75 to $17.00
No. 2 foundry	16.00 to 16.50
No. 2 plain	15.25 to 15.50
Gray forge	14.75 to 15.25
Basic	15.25 to 15.50
Virginia—	
No. 1 foundry	17.25 to 17.75
No. 2 foundry	16.65 to 17.40
Basic	15.30 to 15.90
Southern—	
No. 1 foundry	16.75 to 17.00
No. 2 foundry	16.25 to 16.75
No. 3 foundry	15.50 to 16.00
No. 4 foundry	15.25 to 15.75
No. 1 soft	16.75 to 17.00
No. 2 soft	16.25 to 16.75
Gray forge	15.00 to 15.25
Mottled	14.50 to 14.75

At Chicago—f. o. b.—

Northern—	
Lake Superior charcoal	$20.00 to $20.50
Coke foundry, No. 1	17.50 to 18.00
Coke foundry, No. 2	17.00 to 17.50
Coke foundry, No. 3	16.50 to 17.00
Scotch, No. 1	18.00 to 18.50
Southern—	
Coke, No. 1	16.35 to 16.85
Coke, No. 2	15.85 to 16.35
Coke, No. 3	15.35 to 15.85
Coke, No. 4	14.85 to 15.35
Coke, No. 1, soft	16.35 to 16.85
Coke, No. 2, soft	15.85 to 16.35
Gray forge	14.35 to 14.85
Mottled	14.10 to 14.60
Malleable Bessemer	17.50 to 18.00
Standard Bessemer	18.40 to 18.90
Jackson County and—	
Kentucky Silvery, 6%	19.90 to 20.40
Kentucky Silvery, 8%	20.90 to 21.40
Kentucky Silvery, 10%	22.90 to 23.40

At Pittsburg—

Sand cast Bessemer iron, $15.65; basic, at $15; malleable Bessemer, $15; No. 2 foundry, $14.50 to $14.75; gray forge, $14, all at Valley furnace, the freight rate to Pittsburg being 90 cts. a ton. Ferromanganese (80%), $44.95.

Cast-iron Pipe:

New York—Carload lots, net tons, 6-in., at tidewater, $25 to $25.50.

Chicago—4-in. water pipe, $27; 6-in. to 12-in., $26; over 16-in., $25, with $1 extra for gas pipe.

MISCELLANEOUS MATERIALS—

Copper:

Lake, 12.75 to 12.87½ cts.; electrolytic, 12.50 to 12.75 cts.; casting, 12.37½ to 12.50 cts.

Lead: New York, spot, 4.42½ to 4.45 cts. Spelter: New York, spot, 4.45 to 4.50 cts. Tin: New York, spot, 28.25 to 28.75 cts.

CONTRACT PRICES.

*BARGE CANAL,—Albany, N. Y.—The only bids received by F. C. Stevens, Supt. Public Works, on July 21, for Barge Canal Contracts, No. 60 and No. 64, were submitted by the Empire Engineering Corporation, 60 Wall St., New York. Bids in detail were as follows—(A) Engineer's estimate; (B) Empire Corporation:

	(A)	(B)
Barge Canal Contract No. 60—		
3.5 miles cofferdams, pumping, bailing and draining, per mile	$2,000.00	$2,000.00
Clearing (lump sum)	2,600.00	2,600.00
47,000 cu. yds. grubbing	.30	.36
1,197,000 cu. yds. excavation	.50	.53
10 M. ft. B. M. sheeting and bracing	50.00	50.00
20,000 sq. ft. channeling	.15	.15
735,700 cu. yds. embankment, first-class	.15	.18
163,200 cu. yds. embankment, second-class	.12	.14
24,700 cu. yds. lining	1.50	1.50
63,000 cu. yds. puddle	2.00	2.00
20 M. ft. B. M. sawed lumber (yellow pine or Douglas fir)	55.00	55.00
12,000 lin. ft. foundation piles	.30	.30
30 M. ft. B. M. wooden sheet piling	50.00	50.00
7,100 cu. yds. second-class concrete	7.50	9.00
1,800 cu. yds. third-class concrete	6.50	7.80
1,580 cu. yds. reinforced concrete	10.00	12.00
15 cu. yds. first-class masonry coping	30.00	30.00
67,800 cu. yds. wash wall	2.50	2.50
2,100 sq. yds. second-class stone paving	1.50	1.50
2,400 sq. yds. third-class stone paving	1.25	1.25
550 cu. yds. third-class riprap	2.50	2.50
100 cu. yds. fourth-class riprap	2.00	2.00
94,000 lbs. cast-iron culvert pipe and specials	.03½	.03½
20 lin ft. 12" vitrified pipe laid	.75	.75
20 lin. ft. trenching and backfilling for 12" pipe	.25	.25
800,000 lbs. structural steel	.05	.05
100,000 lbs. metal reinforcement	.04	.04
1,350 sq. yds. wooden pavement, 3" thick	2.75	2.75
650 sq. yds. wooden pavement, 4" thick	3.00	3.00
14,500 lin. ft. wooden fence	.20	.24
65 lin. ft. wrought-iron pipe railing	1.50	1.50
410 lin. ft. lattice railing	1.50	1.50
7 sluice gate valves 36" × 40" (each)	400.00	400.00
2 sluice gate valves 33" × 33" (each)	275.00	275.00
1,000 lin. ft. repointing old masonry	.05	.05
For maintaining navigation (lump sum)	10,000.00	11,000.00
For maintaining highway traffic (lump sum)	3,500.00	3,500.00
Deduct price to be paid to the State of New York for buildings in place which are to be removed by the contractor without expense to the State	1,500.00	1,500.00
Deduct price to be paid to the State of New York for bridge superstructures in place which are to be removed by the contractor without expense to the State	500.00	500.00
Totals	$1,267,301	$1,349,084

	(A)	(B)
Barge Canal Contract No. 64—		
10 miles cofferdams, pumping bailing and draining, per mile	$2,000.00	$2,000.00
Clearing (lump sum)	2,600.00	2,600.00
55,200 cu. yds. grubbing	.30	.36
1,110,000 cu. yds. excavation	.55	.58
413,000 cu. yds. forming embankment, first-class	.15	.18
117,000 cu. yds. forming embankment, second-class	.12	.14
26,000 cu. yds. lining	1.25	1.25
4,000 cu. yds. puddle	2.00	2.00
25 M. ft. B. M. sawed lumber (yellow pine or Douglas fir)	55.00	55.00
3,500 lin. ft. foundation piles	.30	.30
90 M. ft. B. M. wooden sheet piling	40.00	40.00
16,200 cu. yds. second-class concrete	7.50	9.00
2,840 cu. yds. third-class concrete	6.50	7.80
720 cu. yds. reinforced concrete	10.00	12.00
140 cu. yds. first-class masonry	20.00	22.00
20 cu. yds. first-class masonry backing	8.00	8.00
60 cu. yds. first-class masonry bridge coping	30.00	30.00
69,400 cu. yds. wash wall	2.50	2.50
1,400 sq. yds. second-class stone paving	1.50	1.50
2,800 sq. yds. third-class stone paving	1.25	1.25
360 cu. yds. third-class riprap	2.50	2.50
840,000 lbs. cast-iron pipe and Specials	.03½	.03½
955,400 lbs. structural steel	.05	.05
64,000 lbs. metal reinforcement	.04	.04
2,600 sq. yds. wood pavement	2.75	2.75
12,700 lin. ft. wooden fence	.20	.24
5 sluice gate valves, complete in place (each)	250.00	250.00
180 cu. yds. relaying of old masonry	5.50	5.50
1,500 lin. ft. repointing old masonry	.05	.05
For maintaining navigation (lump sum)	12,000.00	13,000.00
For maintaining highway traffic (lump sum)	4,500.00	4,500.00
Deduct price to be paid to the State of New York for buildings in place which are to be removed by the contractor without expense to the State	4,000.00	4,000.00
Deduct price to be paid to the State of New York for bridge superstructures in place which are to be removed by theconstractor without expense to the State	400.00	400.00
Totals	$1,207,330	$1,290,492

For other Proposal Advertisements see pages 43, 44, 45, 46, 50, of Advertisements and Construction News page 54.

FLOWER HILL AVENUE IMPROVEMENT.

Mineola, N. Y.

Sealed proposals will be received by the Clerk of the Board of Supervisors of Nassau County, N. Y., at the County Court House, Mineola, Nassau County, N. Y., until ten o'clock in the morning of Monday, August 31st, 1908, for the general improvement of Flower Hill Avenue, from the Middle Neck Road to Sands Point Road, Port Washington, Nassau County, N. Y., according to plans and specifications prepared by J. D. C. Mackey, Engineer-in-Charge, and on file at the office of the Board of Supervisors of Nassau County.

The time allowed to complete the work will be sixty-five (65) working days.

The proposals will be opened in public by the Board of Supervisors of Nassau County, at their office in the County Court House, Mineola, N. Y., on Monday, August 31st, 1908, at ten o'clock A. M., and they reserve the right to reject any or all bids if deemed for the best interests of the County so to do.

The amount of security required is twenty-five per centum (25%) of the amount of the contract.

Each bid or estimate shall contain and state the name and place of residence or place of business of each of the persons making the same, the names of all persons interested with him or them therein, and if no other person be so interested it shall distinctly state the fact.

Each bid or estimate must be accompanied by the consent in writing of a guarantee or surety company duly authorized by law to act as surety in the County of Nassau, with their respective places of business or residence, to the effect that if the contract be awarded to the person making the estimate they will, on its being so awarded, become bound as his sureties for its faithful performance, and that if he shall omit or refuse to execute the same, they shall pay to the County of Nassau any difference between the sum to whnch he would be entitled on its completion and that which the county may be obliged to pay to the person or persons to whom the contract may be awarded at any subsequent letting.

No estimate or bid will be considered unless made out on blank furnished by the Engineer and must be accompanied by a certified check upon one of the National or State Banks of the State of New York to the amount of Eight Hundred Dollars ($800). Such check or its equivalent must be inclosed in the sealed estimate. All such deposits, excepting that of the successful bidder, will be returned within three days after the contract is awarded. If the successful bidder shall refuse or neglect, within five days after notice that the contract has been awarded to him, to execute the same and file his bond, the amount of the deposit made by him shall be forfeited to and retained by the County of Nassau as liquidated damages for such neglect and refusal; but if he shall execute the contract within the time aforesaid, the amount of the deposit will be returned to him.

The Engineer's estimate of quantities are as follows:

(1) Thirty-five (35) trees to be moved.

(2) Ten hundred and fifty (1050) lineal feet of fence to be taken up.

(3) Three hundred (300) lineal feet of hedge to be taken up and replanted.

(4) Thirty-eight hundred (3800) cubic yards of grading (excavation to be measured only), including taking out drain pipes in front of driveways and taking out cobble gutters.

(5) Sixty-four hundred (6400) lineal feet concrete curb and gutter.

(6) Twenty hundred and fifteen (2015) lineal feet concrete curb and brick gutter.

(7) Six hundred and eighty (680) lineal feet concrete gutter.

(8) Twenty-eight hundred (2800) square feet concrete sidewalk to be taken up.

(9) Twenty-eight hundred (2800) square feet sidewalk to be laid.

(10) Twenty-four (24) catch basins.

(11) Six (6) pair concrete steps.

(12) Fifty-six hundred (5600) sq. yds. macadam.

(13) Rebuilding catch basins at Monroe Street.

The above quantities are stated with as much accuracy as possible, but are approximate only. Bidders are required to submit their bids upon the following express conditions, which apply to and become a part of every bid or estimate received. Bidders must satisfy themselves by personal examination of the location of the proposed work, and by such other means as they may prefer as to the accuracy of the foregoing statement, and they shall not at any time after the submission of their bid dispute or complain of such estimate of the Engineer or assert that there was any misunderstanding in regard to the nature or amount of work to be done or materials to be furnished. The prices submitted are to cover cost of furnishing all necessary machinery, materials and labor, and the performance of all work set forth in the specifications.

The bidder will state the price of each item or article contained in the specifications, per yard or other unit of measure by which the bids will be tested. The extensions must be made and footed up as bids will be read from the total.

The bids will be compared and the contract awarded at a lump or aggregate sum.

Bids and certified check must be enclosed in plain sealed envelopes and endorsed "Bid for Improving Flower Hill Avenue, from Middle Neck Road to Sands Point Road, Port Washington, Nassau County, N. Y."

Plans and specifications may be seen at the office of the Board of Supervisors of Nassau County, at Mineola, N. Y., or at the office of J. D. C. Mackey, Engineer-in-Charge, Port Washington, N. Y., after August 16th, 1908. A copy of plans and specifications will be mailed by the Engineer to contractors upon request. A deposit of Ten Dollars ($10) will be required from each person applying for such plans and specifications, which deposit will be returned upon the return of plans and specifications to the office of the Engineer in good condition.

Dated, Mineola, August 3d, 1908.

By order of the Board of Supervisors of Nassau County, N. Y.

WILLIAM E. LUYSTER,
Clerk.

BRIDGE.

Woonsocket, R. I.

Sealed proposals, endorsed "Proposal for Building a Stone Arch or a Concrete and Steel Arch Bridge on Sayles Street and over the Blackstone River," will be received by Stephen Magown, Chairman of Committee on Streets and Bridges, until four (4) P. M., Friday, August 21, 1908.

Each bid must be accompanied by a certified check for the sum of Five Hundred ($500) Dollars, made payable to the order of the City Treasurer of the City of Woonsocket as surety that if the bid is accepted, a contract will be entered into.

Plans, specifications, and form of proposal and contract may be obtained at the office of the City Engineer.

Contractors may submit design and specification for a steel and concrete bridge.

The right to reject any or all bids is expressly reserved, as the interest of the city may appear.

STEPHEN MAGOWN, Chairman,
JAMES MULLEN,
RAPHAEL P. DAIGNAULT,
Committee on Street and Bridges.
FRANK H. MILLS,
City Engineer.

SEWERS AND PAVING.

Guayaquil, Ecuador.

The "Junta de Canalización y Provecedora de Aguas de Guayaquil" (The Sewerage and Water Supply Board of the City of Quayaquil, Ecuador, S. A.) desires to let contracts for the sewerage and paving works of the city, in conformity with plans, specifications, terms and conditions to be obtained on application to the International Bureau of the American Republics, 2 Jackson Place, Washington, D. C. Bids to be made on special blanks prepared by the Board, and will be opened in Guayaquil, on December 1, 1908.

The Junta has sufficient annual revenues for the work, but desires to find a contractor or company to contract for both the material and financial features of the work.

For further information intending bidders may apply either as above or to the Legation of Ecuador in Washington, D. C.; the Consul General of Ecuador, 11 Broadway, New York, or communicate direct with the Chairman of the Board at Guayaquil, or with the Banco Comercial y Agricola of that City, which is the depositor of the bonds of the Board.

The Board would be pleased to have intending bidders send their representatives to Guayaquil to see for themselves the requirements asked and securities offered.

LAYING WATER PIPE.

Belvidere, N. J.

Contracts to be let for the hauling, laying, joining, digging trench and covering of 30,000 feet of water pipe at Belvidere, New Jersey.

Dated Aug. 4th, 1908.

Buckhorn Springs Water Company,
Belvidere, N. J.

BRICK PAVING.

Westfield, N. J.

Sealed proposals will be received by the Council of the Town of Westfield, N. J., at the Town Rooms, No. 129 Elm Street, on Thursday, August 27, 1908, at 8.15 p. m., for improving Broad Street and Westfield Avenue, between Elm Street and North Avenue, with vitrified brick pavement on 6-inch concrete base, together with the necessary curbing and underdrains.

The Engineer's approximate estimate of quantities is as follows:

2,500 sq. yds. brick pavement on 6-in. concrete base.
1,280 lin. ft. 5-in. by 15-in. straight curb on concrete base,
96 lin. ft. 5-in. by 16-in. radius curb on concrete base,
1,800 lin. ft. 5-in. by 12-in. heading stones on concrete base,
1,600 lin. ft. 3-in. underdrains.

Each proposal must be accompanied by a certified check for $500.00 drawn to the order of the Town Treasurer as an evidence of good faith and the successful bidder will be required to furnish a bond of $5,000.00, with sureties acceptable to the Council, to guarantee the faithful performance of the contract.

Plans and specifications may be examined and blank forms of proposal may be obtained at the office of A. W. Vars, Town Surveyor, No. 129 Elm Street, Westfield, N. J.

The Council reserves the right to reject any or all bids.

Westfield, N. J., Aug. 3, 1908.

LLOYD THOMPSON,
Town Clerk.

U. S. ENGINEER OFFICE, Room F-7, Army Building, New York, N. Y., Aug. 6, 1908.—Sealed proposals for furnishing and delivering paving stone for repairing Small Island Dike in Hudson River, N. Y., will be received at this office until 12 M., Aug. 22, 1908, and then publicly opened. Information on application. JOHN G. D. KNIGHT, Col., Engrs.

BRICK PAVEMENTS AND MACADAMIZING.

Saranac Lake, N. Y.

Sealed proposals will be received until 8 p. m., Tuesday, August 18, by the Village Board of Saranac Lake, N. Y., for furnishing material for and performing labor connected with the following:

9,200 sq. yds. of first-class, fireclay vitrified block laid with 6" concrete foundation on Depot St., Bloomingdale Avenue, Broadway and Main St., 2,200 cubic yds. of excavation and 400 cubic yards of fill for the sub-grade of the brick pavement,

23,000 sq. yds. of macadam roadway on Church St., Main St., Bloomingdale Ave., Broadway and River St., 2,000 cubic yds. excavation and 1,500 cubic yards fill for the sub-grade of the macadam roadway,

1,000 ft. new curbing and 500 ft. resetting old curbing for the brick pavement,

5,000 ft. of new curbing, 500 ft. resetting old curbing and about 10,000 ft. of paved gutter for the macadamized roadway.

In connection with the brick pavement, 300 ft. of 10-in. and 50 ft. of 12-in. vitrified sewer pipe laid with open joints in trench from 3 ft. to 8 ft. deep. One manhole and one catchbasin.

Similarly, in connection with the macadam roadway, 400 ft. of 8-in. pipe, 350 ft. of 10-in. pipe and 60 ft. of 18-in. pipe, in trenches from 3 to 5 ft. deep, 2 catchbasins and two manholes.

It is preferred that one bid be made to include all of the above. Two separate bids may, however, be made; one on the brick pavement with its curbing and drainage, and another on the macadam roadway with its curbing and drainage.

Plans and profiles may be examined and specifications, etc., obtained at the office of the Village Engineer.

The right is reserved by the Board to reject any and all bids.

SEAVER A. MILLER,
Village Clerk.

DONALD F. McLEOD,
Village Engineer.

August 3, 1908.

LAYING SEWER PIPE AND CONSTRUCTING MANHOLES, ETC.

Extension of Moorestown Sewerage system, East Moorestown, Township of Chester, Burlington County, N. J. Sealed proposals for laying the terra cotta sewer pipe and furnishing the materials and constructing the manholes in accordance with the plans, profiles and specifications on file at the offices of Earl Thomson, C. E., Township Engineer, 11 E. Central Avenue, Moorestown, N. J., and 301 Market Street, Camden, N. J., will be received by the Township Committee of the Township of Chester in the County of Burlington, N. J., at the Town Hall, Moorestown, N. J., until 8 p. m., Thursday, August 13, and opened immediately thereafter. The Township Committee reserve the right to reject any or all bids. Plans and specifications may be procured from Earl Thomson, C. E., Township Engineer. Proposals must be accompanied by cash or certified check in the sum of $200.00. By order Township Committee.

CHARLES LAESSLE,
Township Clerk.

A CORRECTION.

A report has come to my notice stating that I advised the Village of Rye, N. Y., to pay royalty for the use of the septic tank process. This report, which I find was circulated by a competitor, is false. A license was offered to the Village of Rye for $1,500. I advised that the offer be declined. Those interested are referred to Mr. Justus A. B. Cowles, President of the Village of Rye.

G. EVERETT HILL,
Vice-Pres. City-Wastes Disposal Co.

CONCRETE VIADUCT.

Atlanta, Ga.

Sealed proposals for the erection of a reinforced concrete viaduct on Ponce de Leon Avenue, Druid Hills, Atlanta, Ga., will be received by the undersigned until noon of August 20, 1908.

A certified check, payable to Forrest & George Adair, for $200.00 must be enclosed with each proposal, which will be forfeited by that bidder to whom the contract may be awarded unless contract shall be entered into by him to construct said viaduct within ten (10) days after he shall have been notified of said award.

The right is reserved to reject any or all proposals.

Viaduct will be 126 feet long, 61 feet wide, and 30 feet above the surface of the ground at highest point.

Plans and specifications may be obtained from the undersigned.

D. LEE WARDROPER,
Civil Engineer,
No. 810 Candler Building,
Atlanta, Ga.

FILTER PLANT.

Peekskill, N. Y.

Sealed proposals will be received by the Board of Water Commissioners of the Village of Peekskill, until eight o'clock P. M., August 25th, for the construction of water filters, pure water reservoir and appurtenances.

Plans may be seen and specifications may be obtained after August 10th, at the office of City Engineer I. W. Reynolds, Peekskill, and at the office of Hazen & Whipple, Consulting Engineers, 103 Park Avenue, New York City.

The work comprises about
13,500 cubic yards of excavation.
4,500 cubic yards of concrete.
4,700 cubic yards of filter sand.
1,100 cubic yards of filter gravel.
Pipes and appurtenances.

A certified check for $2,500 must accompany each bid.

The right is reserved to reject any or all bids.

BOARD OF WATER COMMISSIONERS,
Peekskill, N. Y.

STORM SEWERS.

Canajoharie, N. Y.

Sealed proposals for constructing storm drains or sewers in the Village of Canajoharie, N. Y., will be received until the 17th day of August, 1908, at the office of the Board of Trustees of the Village of Canajoharie, N. Y., until 3 o'clock P. M. of that day, at which time and place all proposals will be opened and read.

Each proposal shall be accompanied with a certified check, payable to the Village Treasurer, for the sum of $300.00; and the successful contractor for the construction of the storm drain or sewer will be required to give a satisfactory bond in the penalty of $2,000.00.

Plans, specifications, approximate quantities and proposed forms may be seen at the office of the Board of Trustees. Copies of the specifications may be had upon application to the engineers.

All proposals shall be addressed "Board of Trustees, Canajoharie, N. Y.," and shall be endorsed with the name and address of the bidder.

For further particulars address village Clerk or Engineers.

The Board of Trustees reserves the right to reject any and all bids.

The work consists of the following approximate quantities:

1,400 lin. ft. 12 to 33-inch pipe laid 6 to 16 ft. deep.
28 manholes and inlets.

ROBERT A. PROBST,
President.

MORRELL VROOMAN,
CHARLES E. PERRY,
Engineers.

SEWERS.

Dalhart, Texas, Aug. 1, 1908.

Sealed proposals will be received by the Mayor at City Hall, until 2 p. m., August 18, 1908, and then publicly opened, for furnishing all the materials and labor necessary to the construction of sanitary sewers. Plans and specifications on file. Certified check $500.00, payable to W. D. Wagner, Mayor. City reserves the right to reject any and all bids.

W. D. WAGNER, Mayor.

CONSTRUCTION OF SEA WALL, CRIB WALL, TRANSPORT WHARVES AND SHEDS.—Fort Mason, San Francisco, Cal., July 17, 1908.—Sealed proposals in triplicate will be received here until noon, Pacific time, August 25, 1908, and then publicly opened, for construction at Fort Mason, San Francisco, Cal., of a sea wall, crib wall, transport wharves and sheds for new Army Supply Depot for Quartermaster's Department, U. S. A., in strict accordance with drawings and specifications by Rankin, Kellogg & Crane, Architects, 1012 Walnut Street, Philadelphia, Pa., copies of which may be had upon application here or to Depot Quartermaster, New York, N. Y., or to Chief Quartermaster Department of the Lakes, Chicago, Ill. Alternative proposals will also be received based on any form of permanent construction. Such alternative proposals must be accompanied by full detail drawings and specifications to be considered. All applications for drawings and specifications must be accompanied by a certified check, in amount $250.00, made payable to Treasurer of the United States, which check, or proceeds of same, will be retained until return of all drawings and specifications. Envelopes containing proposals to be endorsed "Proposals for Army Supply Depot," and addressed Major GEORGE MCK. WILLIAMSON, Q. M., U. S. A.

Situations Wanted

Mechanical and Electrical Engineers.

MECH ENGR., university graduate, with excellent experience in steam turbines, centrifugal pumps and compressors and executive ability, wishes a good salaried position. Address "R. A. 6," Engineering News, New York. 6-2t

Civil Engineers.

CIVIL ENGINEER, technical graduate, six years' experience railroad location and construction, desires position. Present position completed September 4. Age 27. Best of references. Address "L. A. 6," Engineering News, New York. 6-2t

ENGINEER of fifteen years' experience on heavy construction, bridges, tunnels, sewers, water-works, is open for engagement. Ten years engineer of bridges important trunk line railway. Address "O. A. 6," Engineering News, New York. 6-2t

CIVIL ENGINEER, graduate, 5 years' experience on railroad location and construction, heavy masonry, foundations, estimates, drafting and office work. Best references. Address BOX 136, Farmington, Ill. 6-1t

Draftsmen.

DRAFTSMAN, mechanical, graduate technical college; 8 years' experience shop and office, designing and estimating; A1 references. Address "G. 5," Engineering News, New York. 6-2t

COMPUTING, drafting, tracing, printing of all kinds, done at home. STORY, 7010 14th Ave., Brooklyn. 6-1t

STRUCTURAL DRAFTSMAN, 6 years' experience, technical graduate. Address "S. A. 6," Engineering News, New York. 6-1t

Superintendents, Misc., etc.

YOUNG MAN, 24, two years' experience on construction work as inspector, also on test borings, both land and river work. Five years' experience general clerical work. Address "I. A. 6," Engineering News, New York. 6-2t

WANTED—Position as foreman on concrete or general construction work, 6 years' experience in reinforced concrete buildings, foundations and concrete piles. A1 reference. Address "G. A. 6," Engineering News, New York. 6-2t

GENERAL MANAGER and Chief Engineer of large general contracting firm, open, account firm retiring from business. Assoc. M. Amer. Soc. C. E., C. E., married. Familiar with all lines of general contracting, particularly reinforced concrete buildings. Can estimate, design, superintend, manage business and correspondence. Handled work alone in above lines to amount of half million dollars on three buildings in seven months, none of work being sub-let. Can bring large percentage contracts to firm capable of financing same. Address "B. 1," Engineering News, New York. 6-1t

ENGINEER and Superintendent, experienced in design and construction of reinforced concrete and steel frame buildings, bridges, foundations, power plants, electric railways, conveyors, piers, etc., technical education, best references, desires change. Address "K. A. 6," Engineering News, New York. 6-5t

HYDRAULIC AND SANITARY ENGINEER. Experienced in water-power and water-supply investigations, design of power plants, water storage and water supply systems, filtration plants, sewerage and sewage disposal systems, and as construction superintendent. Desires position as Engineer in Charge of design or construction or to make reports on water-power or water-supply projects. Correspondence solicited. Address "H. A. 6," Engineering News, New York. 6-5t

YOUNG ENGINEER (24), experienced on heavy excavation and construction work. Two years on Pennsylvania tunnels; good executive ability. Moderate salary. Address "M. A. 6," Engineering News, New York. 6-2t

FOREMAN, young man, 26 years of age, desires a position as foreman, six years' experience on sewer work, rock and wet trenches; go anywhere. Address "P. A. 6," Engineering New, New York. 6-2t

GRADUATE ENGINEER desires position; five years general superintendent for concrete building construction company; previous experience in railroad, trolley and municipal work; references. Address "K. A. 3," Engineering News, New York. 6-12t

Situations Open

AN INCORPORATED Contracting Company, specializing in foundation work and controlling valuable patents and plant for same, wishes to secure as Secretary a competent and experienced engineer who is a good, hustling executive and able to invest $10,000 or more. An excellent opening for the right man. Address "P. A. 6," Engineering News, New York. 6-2t

WANTED.

SURVEYOR

for small topographical survey; must be ACCURATE, quick, and thoroughly familiar with stadia methods of taking levels and topography. Opportunity for a vacation at the sea-shore. Address, with price, "W. A. 6," Engineering News, New York. 6-1t

Miscellaneous Wants

WANTED.

4,000 ft. 4" and 3,000 ft. 6" wrought-iron pipe; 2 pieces wire rope, 2", 2¼" or 2½" diameter, 900 to 1,000 ft. lengths. 2-8¼ x 10 or 12 Double Drum Skeleton Hoisters. Give cash prices and where can be seen.

LOCK BOX 12,
Phillipsburg, N. J. 6-1t

WANTED.

A Gasoline Inspection Car

to carry half dozen packages.

KIMBALL LUMBER MFG. CO.,
St. Louis, Mo. 6-4t

FOR SALE

BARGAIN IF SOLD QUICK.
24—40 ft. 60M capacity

FLAT CARS

Good condition. Act quick if wanted.

WALTER A. ZELNICKER SUPPLY CO.
IN ST. LOUIS.
6-1t

FOR SALE.

Complete files of the Eng. News and Supplement (except May 7, '03, and Sept. 13, '06) from Mar. 21, '01, to Mar. 21, '07, all unbound. Will sell single volumes or the whole lot to person making the highest offer before Aug. 15. Address G. W. PENFIELD, 186 New Britain Ave., Hartford, Conn. 6-tf

FOR SALE.

One No. 1 5-ton Gibbs Engineering & Mfg. Co.'s electric truck, with winch hoist, pulling capacity, 6,000 lbs. Contains 44 cells of 19 M V exide batteries, complete. Solid rubber tires, 7" x 36". Bed of truck is 15' 7" long and 6' 8" wide. This truck is in excellent condition and will be sold at a sacrifice. Apply to

The Bell Telephone Company of Missouri
St. Louis, Missouri. 6-1t

FOR SALE

A. B. C Pressure Fan, belted type, 60" x 24" wheel; good for 800 boiler horsepower as forced draft fan. First-class condition.

Apply to JOHN M. NICHOLSON,
Westinghouse Machine Co.
131 State Street, Boston, Mass. 6-1t

Contractors' Second-Hand Equipment

13 No. 2½ Western Wheeled Scrapers.
1 No. 10 Western Rock Crusher with Elevator, on wheels.
1 18-HP. Farquhar Improved Boiler and Engine Outfit on Wheels.
9 1½-yard Western 24" gage two-side Dump Cars.
14 1¼-yard Western 24" gage two-side Dump Cars.

All in first-class second-hand condition.

Immediate delivery. Low prices.

Inquiries solicited for Road Machinery of all kinds.

Selling Agent American Motor Road Rollers.

HOMER BOWES
Pittsburgh (Northside), Pa. 6-1t

Complete Contractor's Plant

FOR SALE.

Including Air Compressor and Receiver; Cableways; Boom Derricks; Ingersoll Steam or Air Drills; Columns, Blacksmith Shop; Tools; Pipe, etc.

Can be seen in operation. For sale cheap.

Write or call. 6-1t

CAPONE & TROST,
447 Summit Ave., West Hoboken, N. J.